ELECTRONICS AUSTRALIA

VIDEO, HIFI & COMPUTERS

AUST $1.80* NZ $1.90 AUGUST 1981

BUILD THE SUPER 80 COMPUTER!

MUSICOLOUR: LIGHTS UP YOUR MUSIC

DESIGNING VENTED SPEAKER ENCLOSURES

SATELLITE TELEVISION FOR THE OUTBACK

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Close the car door, turn on your Sony car stereo and let us give you the finest sound on wheels.

Imagine your car filled with the sound of the Sony XR-77 car Hi-Fi with built-in 20W + 20W power amplifier and loudness control. Imagine the cassette player with Dolby noise reduction, metal tape capability, an automatic music sensor, locking fast-forward and rewind.

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Listen to it, and imagine how good it would sound in your car.

SONY®

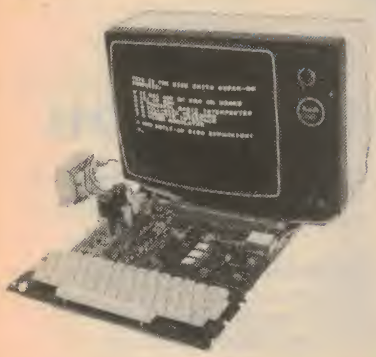
SON 0030

ELECTRONICS AUSTRALIA

Volume 43, No. 8
August, 1981

AUSTRALIA'S HIGHEST SELLING ELECTRONICS MAGAZINE

Super-80 Computer Kit



Yes, it's finally here! This build-it-yourself computer features a powerful BASIC interpreter, up to 48K of RAM on board, a full-size keyboard and an RF modulator for TV display. Details p70.

FEATURES

HIFI, VIDEO AND REVIEWS

PROJECTS AND CIRCUITS

MICROCOMPUTERS

AMATEUR RADIO, CB SCENE, DX

COLUMNS

DEPARTMENTS

COMING NEXT MONTH! – Find out what's coming by turning to p6.

On the cover

Set against the spectacular backdrop of Ayers Rock, this low-cost satellite ground station will bring television to thousands of people in the Outback for the first time. Our story on p12 has the details. (Photographs courtesy Hills Industries Ltd, 506-508 Guildford Rd, Bayswater, WA 6053).

The most important feature of a small computer...

...is where you buy it.

It's the key to making the most of your microcomputer system. Because the right computer store will provide you with the support, service, software and supplemental equipment that can make the difference between total satisfaction and total frustration with your system.

Filling this vital role was the concept behind ComputerLand. Our purpose is to provide you with ready access to the entire world of microcomputing. Today we represent over 50 different manufacturers and suppliers. But no matter what brand or type of equipment you purchase or lease from ComputerLand, you get an extra feature no one else can offer — the resources of the world's largest network of computer stores.

Information. At ComputerLand, you deal with a staff of thoroughly trained and experienced professionals. We know small computers. And since we deal only in small computers, we know them a lot better than anyone who also has to know CB radios, burglar alarms, stereos, TV sets, copy machines and typewriters.

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We can also put you in touch with computer clubs, classes, and other customers who have situations similar to yours.

Choice. ComputerLand has the widest selection of small computer products you'll find anywhere. And every product we offer has been evaluated and approved by our expert product selection committee.

We have no ties to any single manufacturer, so we don't have to try to sell you any single brand. We can combine computers, accessories, and programs from several different sources to meet your specific needs. You don't have to adapt your needs to fit our system. At ComputerLand, you have complete freedom of choice. Because we do. And as your computer needs expand, we have the add-ons and programs that can make your computer expand as well.

Support. The right computer store becomes even more important after you buy. Because that's when you'll need warranty service, routine maintenance, technical assistance, training, software — or just someone friendly to call when you have a question. ComputerLand provides all of the above and then some.

We give your equipment a complete checkout before it leaves the store. We can do most repairs in-store so you don't have to wait while your equipment makes a round trip to the manufacturer. And if the equipment is needed for business, we can provide priority service. So come to ComputerLand and let us introduce you to small computing. We want to be your computer store.

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Editorial Viewpoint

Technology: servant, not master!

In mid-April, about 200 representatives from the European press, and from radio and television stations converged on Salzburg, in Austria. The occasion was an official presentation of the Philips compact audio disc – a format which is likely to succeed the present-day LP and which offers a variety of advantages:

It is small (diameter 12cm); it can accommodate one hour of program per side, with vastly improved technical quality; it is unaffected by handling or dust, is not subject to wear, and is suitable for use in vehicle hifi systems. If desired, additional information can be encoded along with the sound, such that track titles and even lyrics could ultimately be displayed on a read-out panel.

Those attending the presentation were exposed to the full technical clout of Philips and Sony, and to the full musical clout of Polydor and of Herbert Von Karajan, notable amongst the World's notable conductors and an enthusiastic supporter of the digital system. After the introductions, the speeches and the explanations came the music – snatches from three recent Karajan opera presentations and, finally, the piece de resistance – "The Great Gate of Kiev" from Moussorgsky's "Pictures at an Exhibition".

This last earned a standing ovation from the audience but a number of music critics came away with deep reservations about what they had heard. The sound was massive and brilliant, to be sure, calling to mind Leo Simpson's heading to an article some months back: "Strewth it's loud: must be hifi!" Reportedly, this was a veritable wall of sound, technically impressive but lacking dimension and texture. Was it indicative of the system, or of something else?

According to Peter Herring, Editor of the British journal "Practical HiFi", the musically "grotesque" "Great Gate" may well have been the result of over-zealous use of technology, as distinct from the technology itself. When one has access to a 32-channel digital recorder and to computer controlled mixing facilities, free from cumulative noise and distortion, there is an enormous temptation to indulge to extremes in multi-mic and multi-mix techniques.

Indeed, Von Karajan appeared to take the view, at Salzburg, that the technical resources now available to an engineer make it possible for him to illuminate and elucidate the music for the listener. Reportedly, the maestro himself was closely involved in the mix-down for the demonstration recording, which turned out to be rich in spectacle but lacking in those qualities which we tend to associate with a performance by an orchestra made up of real people in a real concert situation.

A modern mixing console may look a bit like a Bosendorfer Grand but is it really part of a classical orchestra?

Neville Williams

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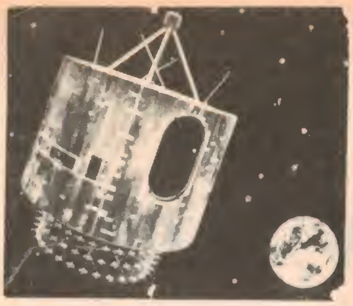


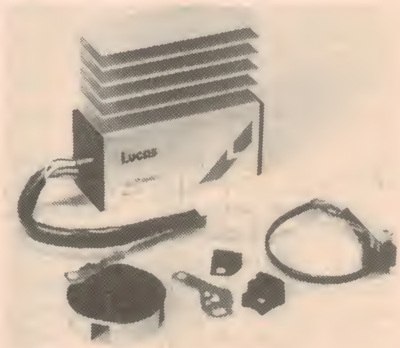
News Highlights

New breakerless ignition system suits wide range of vehicles

Lucas Industries Australia has released a range of Contactless Electronic Ignition Systems for vehicles on Australian roads. The basic unit, in conjunction with a small range of installation kits, can be fitted to 332 different models of passenger cars and 120 commercial types.

The Lucas Electronic Ignition is designed to replace the conventional contact set and capacitor. By dispensing with the contact set high speed point bounce, low speed arcing and general wear and tear are eliminated, resulting in improved high speed performance, improved starting and smoother idling. Because there are no moving parts to wear out, the engine stays in tune and timing remains constant, resulting in less petrol wastage.

Lucas have been making electronic ignition systems for Formula One racing cars for many years, where the demands of reliability and performance are high. With this experience they have created a Contactless Ignition System which can be easily used by any motorist.



The kits come complete with detailed illustrated instructions for installation, and are available for 4, 6 and 8 cylinder Holden, Ford, Chrysler, Datsun, Leyland and Toyota .vehicles and European makes. The system consists of a fitting kit to suit the particular vehicle and one main amplifier kit, and is available from all Lucas branches and distributors.

Computer terminal prints in Arabic

A computer terminal designed in Canada is capable of generating the Arabic language with all of the 140 different letter shapes and the 13 possible accent marks the language can require.

In the past, Arabic script was adapted to machinery devised for the Latin alphabet as used in the West. The Arabic produced, while legible, was in a script which displeased many Arabs and created cultural tensions, particularly in the more conservative countries.

The problem is that the shapes of Arabic letters change according to the letters which come before and after them. For example "ABC" in Arabic is written with a different form of letters than those used to write "BCA". There are no standard rules by which a student of Arabic learns to make the required letter changes when writing the language — they simply learn by copying. Some letters can have as many as five different shapes, each correct in some contexts and incorrect in others.

A further difficulty is the positioning of accent marks in Arabic script. Some letters have two accents over them, which must be precisely positioned in relation to each other. The new computer terminals overcome these problems.

The breakthrough was the work of a Montreal, Canada, professor, Syed Hyder, who has discovered a linguistic relationship between 16 groups of Arabic letter shapes. This relationship can be expressed in a computer algorithm which enables the computer to select the correct shape for each letter, depending on where it appears in the text.

The Hyder algorithm was program written into a computer memory chip which controls the operation of an electronic typewriter. When typing in Arabic the computerised memory takes control of the typewriter, deciding what forms of letters should be used in the text and selecting the correct character.

Talking calculator from Panasonic

Although talking learning aids have been on the market for some time (Texas Instruments "Speak and Spell" for example), and talking calculators have been available for the blind, the first such commercial device was launched recently in Australia by Panasonic — although it has been available in Japan for the past year.

The Panasonic talking calculator is a 10-digit calculator in which any information appearing on the digital display is also reproduced by a small built-in loudspeaker. Calculations with up to 255 steps may be reviewed either step by step or continously with the voice unit.

The machine has a voice synthesiser with a 31 word vocabulary, a three position volume control, a voice on/off switch, and a three-speed switch to allow the user to choose the most convenient speed for the voice read-out.

"Seeing-eye" computer

An aid for the blind developed at the Smith-Kettlewell Institute for Visual Sciences in San Francisco uses a shoulder-mounted television camera to produce images of nearby objects. An attached computer processes the image within half a second and identifies objects for the wearer, using electronically generated speech. The computer also generates tactile signals which inform the person of the direction and distance of the object.

The "seeing eye" system is still under development and will shortly undergo tests in real-life situations.

Telecom tests fibre-optics

Telecom Australia recently took a major step towards the introduction of fibre-optic cables in telecommunications with the laying of eight kilometres of optical fibre cable between Telecom's Clayton and Springvale telephone exchanges near Melbourne.

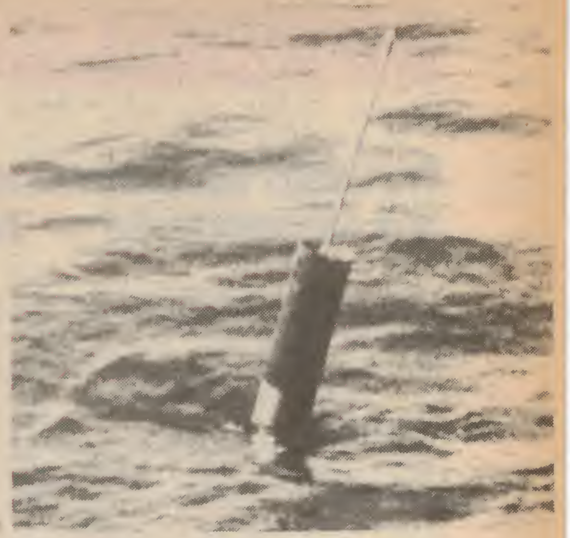
The new cable will not carry telecommunications traffic for the time being, but will undergo extensive tests by Telecom research staff. It will be tested using simulated telephone signals and limited video transmissions.

Electronic test range for RAN

The recent completion of a complex electronic facility at the RAN's test range at Jervis Bay will ensure a continuous program of testing for the Australian designed Barra anti-submarine sonobuoy. Equipment inside the "Sonobuoy Test Range Instrumentation Complex" includes modern computer-controlled instrumentation designed and manufactured during the last five years by the Defence Science and Technology Organisation's Defence Research Centre at Salisbury, South Australia.

Primarily the test range is designed to provide testing facilities for the Barra sonobuoy designed by the Defence Research scientists and developed by Australian industry. The sonobuoy is a device dropped into the sea by aircraft to locate submarines. It consists of a surface buoy and a submerged array of sensitive hydrophones to detect noise emissions from ships and submarines. The buoy on the surface contains a radio transmitter for reporting the acoustic data.

The buoy is now being manufactured by Amalgamated Wireless (Australasia) Ltd as prime contractor, and is being delivered to both the RAAF and the RAF. Samples are selected at random from manufactured batches of sonobuoys and tested at the Jervis Bay range in conditions similar to those expected during operational use. From reports of the test results an assessment can be made of the quality of the Barra sonobuoys being manufactured.



The Barra Sonobuoy.

Solar-powered communications

A solar-powered communications system, said to be the most extensive in the world, is under construction in the Kimberley region of Northwest Australia. Telecom's plans for the $16 million project are well under way, and the timetable calls for completion of work from Port Hedland to Broome and Derby by December 1982 and links to Wyndham and Kunamurra by December 1983.

The first of the microwave repeater sites is under construction at Yeeda, a remote site 42 kilometres south of Derby. Forty such repeaters will make up the complete system.

Semiconductor plant for Canberra

National Semiconductor Corporation has stated that its proposed silicon chip plant in Canberra would construct chips from the design stage, with 95% of the work being done in Australia. It was earlier believed that only the first stages of manufacturing would be done here.

Two representatives of National recently visited Australia to work on a feasibility study of the project. As part of the incentives which attracted National to Canberra the Federal Government will provide land and construct buildings for the plant to National Semiconductor's specifications. The Government will retain ownership of the land and buildings.

The plant is intended as a major supplier of a range of standard devices, and if things go according to plan should reach full production by 1987. As part of the agreement with the Australian Government, National will also set up an applications company in conjunction with local groups.

Simple device plots yearly Sun path

How do you position a solar hot water heater, a swimming pool, or a clothesline to gain the maximum amount of sunshine? Mr David Hassall, Senior Lecturer in the School of Building at the University of NSW has come up with an answer – and it costs $1.00.

Mr Hassal has invented a simple device which he calls a 'Sun-path Finder' for checking the position of the sun in relation to a particular site throughout the year. The Sun-path Finder is a small box with a viewing hole on one side and a transparent screen with a computer-generated solar position diagram on the other side.

In use, the Finder is pointed North, as indicated by a compass inside the box, and tilted until an attached plumb-line hangs vertically through the location hole. The diagram on the screen then indicates the path of the sun through the year, allowing the user to determine if a tree or building will block the sun at any time.

"It can be used by architects to check solar access to building sites, by householders, and by children for school projects," says Mr Hassall. "It can be used at any latitude from the equator to the poles, and is surprisingly accurate".

Two prototypes of the device have been built so far, one of cardboard and the other of wood, but Mr Hassall would like to see them moulded of plastic. He estimates that the manufacturing cost should be about $1.00. A patent application has been filed for the Sun-path Finder and it was recently featured on the ABC's program "The Inventors".

GE wins patent for oil-eating "bug"

General Electric Corporation of the United States, the world's biggest electrical engineering group, also has an ongoing research program in genetic engineering. One of the first products of the program was the invention, in 1976, of a bug that would eat oil. The idea was that a bug might be useful in eliminating slicks caused by oil spills.

The scientists at GE took three closely related bacteria, each able to eat one fraction of crude oil, and bred them into a stable hybrid with a taste for "whole crude".

At the time of the invention GE tried to patent the new bacteria but the application was refused. After an appeal to the US Supreme Court a patent was finally granted in March this year. Exploitation of the bacteria will require extensive study of possible side effects, and GE itself will most probably licence the patent to one of the small entrepreneurial companies that sprang up in the late '70s to exploit genetic engineering.

General Electric has concluded that gentic engineering – the transplantation of genes from one bacteria to another – could have exciting possibilities in several major areas of its business. Bacteria with a taste for a particular metal could be used to enrich a deposit of poor quality ore, for example.

Dr Roland Schmitt, vice-president of GE's corporate research and development, compares the current state of genetic engineering to the first years after the invention of the laser. "There was a tremendous explosion of ideas. We began by thinking of a vast army of possible uses. Then came the problem of doing it. The doing is a lot harder than the thinking".

NEWS HIGHLIGHTS

Do radio transmissions affect the ionosphere? — contract to Lockheed

Scientists at Lockheed's Palo Alto Laboratories have begun a research project to determine how radio transmissions may alter the ionosphere and hence disturb long range radio communications. Under a contract with the US Office of Naval Research, Lockheed has designed and built a satellite-borne experiment to determine if radio transmissions at very low frequencies affect the free electron content of the ionosphere.

It is suspected that very low frequency radio transmissions at high power levels induce the precipitation of electrons from the earth's magnetosphere into the ionosphere. Such precipitation causes irregularities in the ionosphere which can disrupt or degrade extremely low frequency (ELF) and very low frequency (VLF) communications.

Called Stimulated Emission of Energetic Particles (SEEP) experiment, the program is a joint effort of Lockheed's Space Sciences Laboratory and the Radio Sciences Laboratory of Stanford University.

The ionosphere is a layer of charged particles which begins about 35 kilometres above the earth's surface and extends outwards for several hundred kilometres. It acts as a radio mirror, reflecting signals and making long distance communication possible.

The charged particles of the ionosphere also shield the surface of the earth from the destructive effects of high energy ultraviolet radiation, so the effects of disturbances of the ionosphere go beyond disruption of radio communications.

The US Navy already has a number of existing and proposed communication systems which use very low frequencies, including the Omega navigation network and the satellite system used by nuclear submarines for navigation and communication. These systems operate in the 3 to 30kHz range, which resonates with the natural frequencies of the trapped electrons in the magnetosphere.

Lockheed scientists with the system that will investigate the effect of radio transmissions on the ionosphere.

The SEEP experiment will be orbited aboard a satellite and the system's detectors will observe electron precipitation while several high-powered transmitters at different locations on the ground are keyed on and off. This will enable researchers to establish a positive cause/effect relationship between low frequency radio transmissions and disruption of the ionosphere.

Dick Smith/Yaesu contest winner

Ike Bain (left), Managing Director of Dick Smith Electronics, presents Bill with his ticket to Hong Kong.

Dick Smith Electronics has announced the winner of the Yaesu "Win-A-Trip-to-Hong Kong" competition. He is Mr Bill White, VK2ZWF of Bondi Junction, NSW.

Anyone who purchased an item of Yaesu amateur radio equipment during the contest period received an entry form. Entrants had to tell Dick Smith Electronics the best way the company could promote amateur radio to the benefit of Australia.

The winning entry was chosen by EA Editor-in-Chief Neville Williams.

Next Month* in "Electronics Australia"

☆ Marantz/EA Crossword Competition — the winners!

☆ Digital thermometer/clock

☆ Building the Super-80

☆ EA/Olbis CB Contest — Results

PLUS

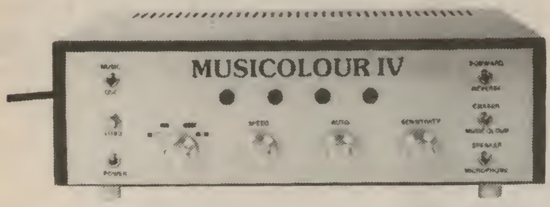
PHOTON TORPEDO:
a new electronic game with sound effects

*Our planning for this issue is well advanced but circumstances may change the final content. However, we will make every attempt to include the articles mentioned here.

KITS! KITS! JAYCAR

ELECTRONICS AUSTRALIA 4-CHANNEL MUSICOLOR/LIGHT CHASER

See EA August 1981 (this month).
This very popular kit has now been IMPROVED out of sight!!! Why pay for 2 kits when you can get both - a Lightchaser and Musicolor - 4 channel in the one box!!



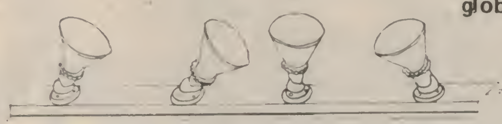
Staggering value at $94·50 for the COMPLETE kit.

SPECIAL!! Spotlight bank to suit your new Musicolor/Chaser. You get 4 x E.S. lamp fittings, special metal (pre-punched) mounting bracket, wiring terminals etc*
CAUTION. As the Musicolor/Chaser is a 240V mains device it is essential to keep your mains wiring safe. The Jaycar spotlight bank will help keep your wiring safe - - - - -

*The Jaycar spotlight bank will mount on to any flat surface and looks great! Call in to our showroom and see for yourself!

Complete kit ONLY $29.50 great value!

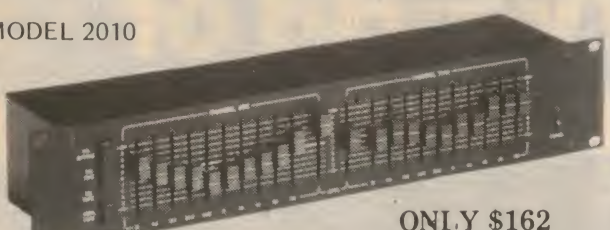
(Does not include globes)



FLOODLIGHTS: Yellow, Red, Blue, Green ONLY $7.95 each!!!

2 CHANNEL EQUALISER KIT

MODEL 2010



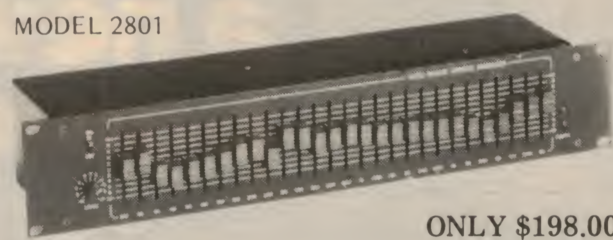
ONLY $162

The 2010 is a two channel graphic equaliser featuring ten adjustable controls on octave centre frequencies (independent for each channel). Each control provides up to 14dB of adjustment. Each channel is also equipped with a level match control giving an overall gain of 14dB.
The functional versatility of the 2010 equaliser is unsurpassed. Eight modes of operation are available from the push button switches on the front panel
Included amongst these are the ability to equalise both recording and playback when dubbing. The 2010 has been designed to be compatible with all commercially available equipment and is ideal for use in a Hi Fi system or P.A. system.

Truly magnificent — Electrically identical with the ETI 485 Graphics Equaliser, the Jaycar 2010 Kit comes in a 19" rack cabinet and features attractive front-panel mounted push button changeover switches.

THIRD OCTAVE EQUALISER KIT

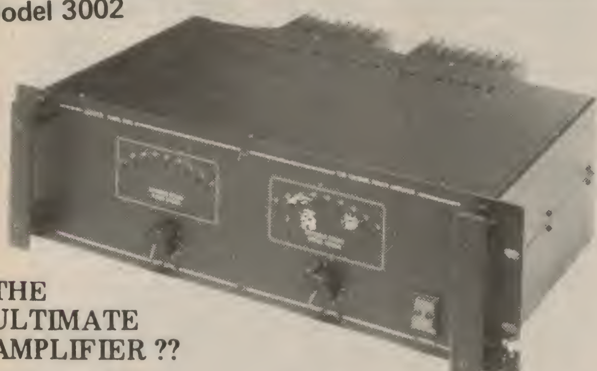
MODEL 2801



ONLY $198.00

The 2801 is a single channel graphics equaliser that divides the audio spectrum into twenty-eight one third octave bands. Each frequency segment is controlled by a slider that provides up to 10dB of adjustment in standard ISO steps.
The 2801 was designed primarily to compensate for any deficiencies in the linearity of speaker systems, acoustic peculiarities of the hall or listening room, and inadequacies of program source quality. In PA application the equaliser may be used to improve sound quality and increase intelligibility by attenuating problem frequencies that cause ringing, boominess, or other disruptive resonances that occur in acoustically difficult rooms. The 2801 allows sound systems to be 'tuned' according to the special acoustics of a room, to maximise ouput and minimise feedback. As a creative tool in a sound recording or re-recording the 2801 allows complete freedom to contouring response over the complete audio spectrum from 31.5Hz to 16kHz.

Model 3002



THE ULTIMATE AMPLIFIER ??

Includes 28 page Manual

ONLY $489

That's what some people have called the Jaycar 3002.
Jaycar Engineers started with the well-proven ETI 466 amplifier modules. They reconfigured the PCB so that it would fit vertically into a 5¼" x 19" Rack Cabinet. They then designed a rack cabinet to take the weight of the two massive rear-mounted Philips 65D heatsinks and the two enormous Ferguson transformers. A special sub-panel was designed to house the two LED power level meters. A special loudspeaker protection circuit was also provided.
The only thing that each channel has in common is the 240V mains! You can imagine the stereo separation. If you're into High Power Hi Fi then you must see and hear this unit.
FEATURES: 300 watts per channel + Massive rear mounted heatsinks + Multiple speaker protection circuits Peak output power meters + Constructed to withstand the tortures of 'On the Road' use + Standard 19" rack mounting + Separate power supplies for each channel + Dual RCA input sockets to allow bridging to other amplifiers + Equally suited to Hi Fi use or P.A./Disco situations.
BRIEF SPECIFICATIONS: Output power: 300 watts/channel into 4 ohms. or 200 watts into 8 ohms. Frequency Response: 20Hz to 20kHz 0.5dB. Hum and Noise. 105dB below rated output. Harmonic Distortion: Less than 0.05% to 80 watts. Less than 0.15% at rated power. Input Sensitivity: 1.0 volts for rated output. Dimensions: 482mm x 133mm x 340mm. Weight: 20kgs.

OTHER KITS

ELECTRONICS TODAY INTERNATIONAL	
ETI 330 Car Burglar Alarm July 1981	$24.50
ETI 446 Audio Limiter	$9.00
ETI 480 50 Watt Module	$23.00
ETI 480 100 Watt Module	$27.00
ETI 466 300 Watt Module	$70.00
ETI 473 Moving Coil Pre-amp absolutely complete	$95.00
ETI 729 UHF Masthead Amplifier	$35.00
ETI 735 UHF Convertor	$32.50
ETI 458 Peak Reading Level Meters	$37.50
ELECTRONICS AUSTRALIA	
On Screen Analyser March 1981 Comp. inc. BOX SPECIAL	$99.50
Colour Option (TEA1002 8.86MHz x'tal)	$25.00
Le-Gong March 1981 (Case Extra) SPECIAL	$9.75
PC Birdies May 1981 Complete	$14.95
P.C.B. for above (Special Price) ONLY	$1.65
2-Channel I.R. Remote Control Complete	$65.00
Sound Level Meter May 1981 Complete	$39.50

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We also stock the entire range of fun-to-build kits from "Hobby Electronics" Marine.

The Official Line

— from the Department of Communications

Managing the frequency spectrum

If you use any radiocommunications equipment for transmitting messages you must have a licence for it. This includes all appliances used to transmit by wireless telegraphy, except for broadcasting and television transmitters. It includes ships' radios, radios used for transport and messenger services, citizen band radios, amateur radios and many others.

As a signatory to the International Telecommunications Union Convention Australia is obliged, together with the other signatories, to co-operate in managing the spectrum in an orderly manner. Without this, effective communications by radio would be impossible.

But it costs money to manage the spectrum, and for 1981/1982 the cost will be approximately $19 million. The majority of this amount goes on salaries, rent and equipment to provide the machinery to allocate frequencies, investigate interference, monitor the spectrum, plan the bands and grant approvals for types of equipment.

The Government expects the Department to recover its costs in managing the spectrum and this had led to licence fees for both Government and non-government users. The cost of managing each type of radiocommunications service is thus borne by the users of the service.

There are penalties under the Act for not complying with it, and this includes operating equipment without a licence. Penalties include imprisonment of up to five years and fines not exceeding $1000 and also for seizing and forfeiting equipment.

The Department maintains a staff of inspectors to detect, apprehend and prosecute unlicensed operators and also licensed operators contravening the Act in other ways.

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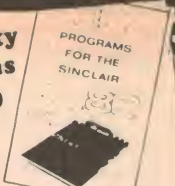

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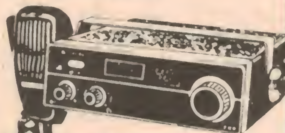

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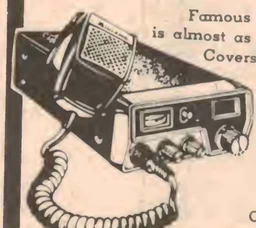

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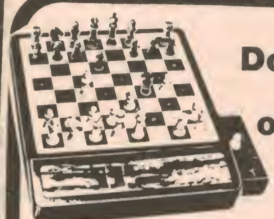

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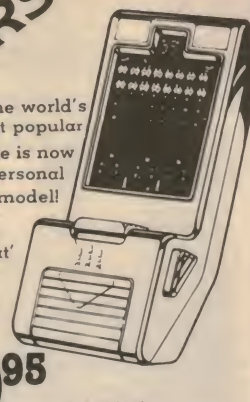

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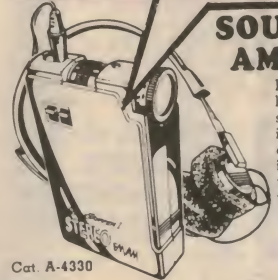

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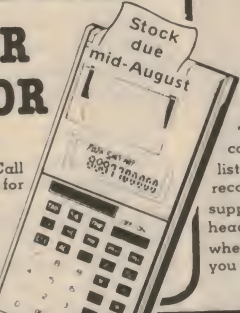

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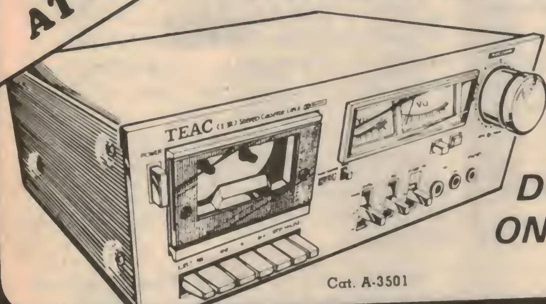

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Satellite television for the Outback

City dwellers in Australia tend to take television for granted, accepting as their right clear reception and a wide variety of programs. It is easy to forget that a significant number of people living outside the capital cities do not have access to commercial TV, and that for many in remote Outback areas, there is no TV at all.

Things have changed in the Outback since the Rev John Flynn wrote of a handful of people inhabiting millions of square miles towards the centre of the continent, far out of reach of either railways or telegraph lines. But, despite some changes, loneliness and isolation remain a problem for many who live in the remote regions of Australia.

In the city, sated with the latest re-run, we might doubt the advantages of television reception — but how differently would we feel if the TV wasn't there to be turned on; if we didn't have the choice to watch it or not? Now thousands of people in isolated areas of Australia will be given that choice for the first time.

The first commercial system to bring television within the reach of hundreds of thousands of people in the Australian outback was launched recently at news conferences in Sydney and Perth. Called the "Hills Telesat", it is a low-cost satellite ground station that picks up signals from Intelsat IV, the international communications satellite, and produces quality colour television reception across a vast area of the continent. It is the first system of its type to be marketed and installed commercially anywhere in the world.

Hills' Telesat system was designed last year in Perth by a leading American communications scientist, Professor Taylor Howard of Stanford University, exclusively for Perth-based Australian Microwave Systems Pty Ltd. The Professor, who is a director and shareholder of Australian Microwave, was "present" at the launch through a live two-way satellite link-up with San Francisco.

The curved reflector screen for the Hills satellite TV system is shown here under construction.

The system itself consists of a curved screen, five metres square, which reflects microwave transmissions of ABC television from Intelsat IV into a collecting horn about seven metres away. Signals are then amplified by a special low noise amplifier, modulated and converted to a lower frequency by a converter unit, and fed by coaxial cable to a tunable receiver which plugs into any standard colour television set.

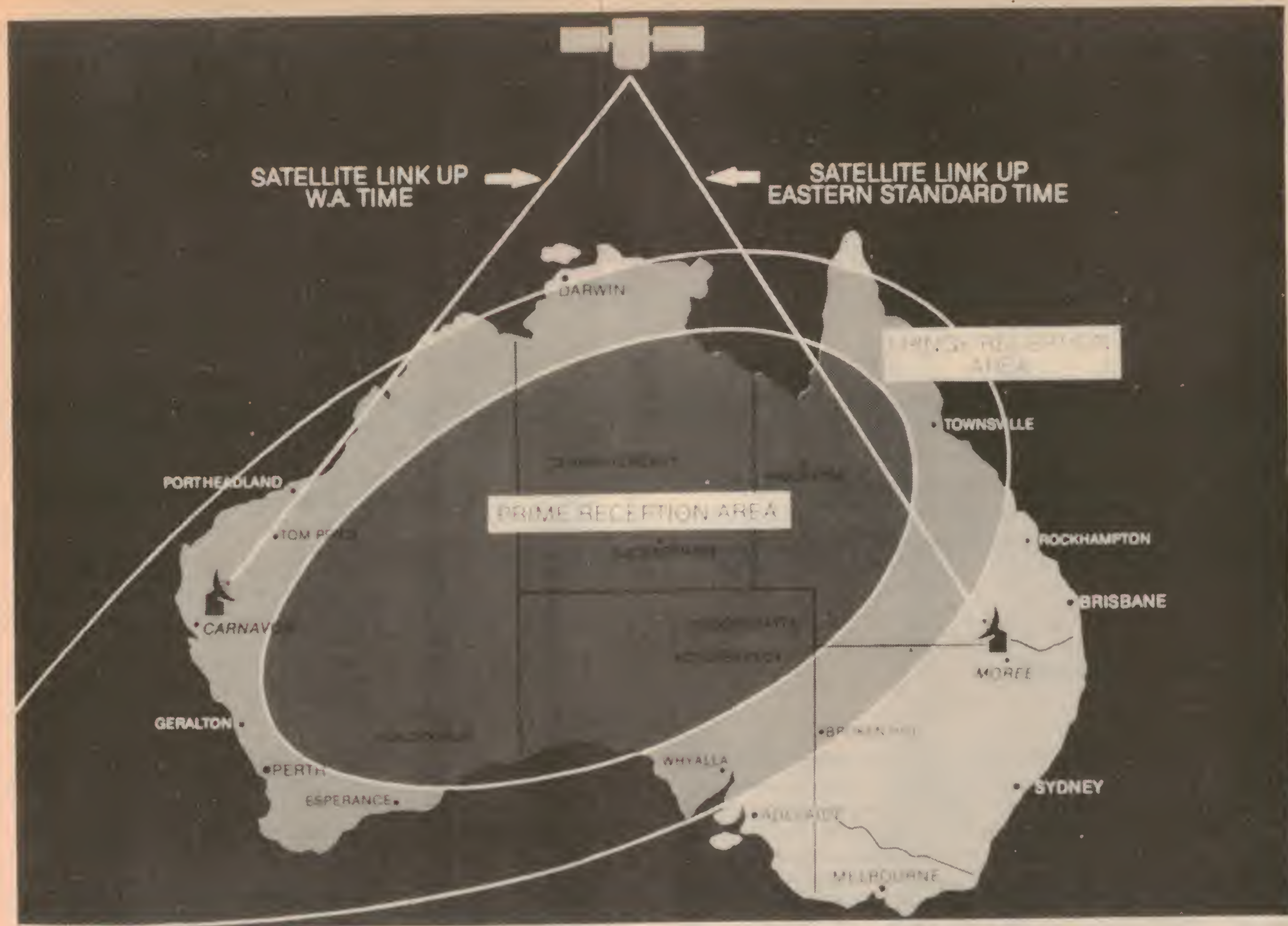
The central "footprint" of Intelsat IV covers a vast area of Australia, extending over most of Western Australia, South Australia, Northern Territory, Western Queensland and also part of NSW (see accompanying map). According to Hills, ABC television programs from both Sydney and Perth can be received, with a picture quality within the central footprint as good as the average suburban home.

The Hills Telesat systems are expected to cost around $7000 to $7500, depending on location. This price includes all of the components, installation and travelling charges, and also includes sales tax. However, Hills says that it hopes that the systems will be exempted from sales tax because of the tremendous benefits they will provide to Outback people. If so, the price will naturally be lower.

Telesat systems have been tested and proved at various locations over the past few months, and the first system sold was installed just a few months ago at the Uluru Motel at Ayers Rock and is performing well. Already the Australian energy company, Santos Ltd, is negotiating for a system to be installed at Moomba in South Australia's far north to bring daily television to its employees on site. Santos and Hills are also discussing the possibility of a mobile system to take to drilling rigs.

At the launch, Mr Bob Ling, the Managing Director of Hills Industries Ltd, said that the only other systems capable of receiving satellite transmissions in Australia at present were the big Telecom and OTC earth receiving stations using very large dish antennas, and probably costing between $50,000 and $100,000 each.

"While the Federal Government has plans to establish 52 of these earth receiving stations at certain remote communities, each one will only provide TV



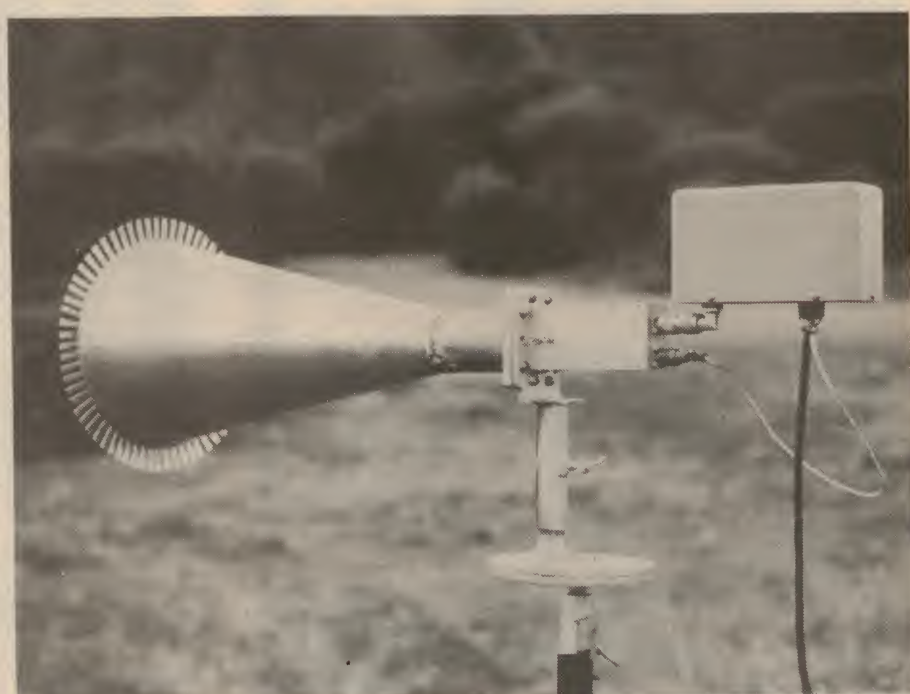
Shown above is the coverage area, or "footprint" of the Intelsat IV satellite. Hills Industries Ltd guarantees clear reception of ABC television broadcasts when their Telesat system is used in the prime reception area.

reception within a radius of approximately 35 kilometres. It seems also that the Australian domestic satellite debate could continue for a long time yet, so our system offers immediate television to people in the Outback", Mr Ling added, "If and when an Australian satellite is put into orbit, we expect that the Hills Telesat system can be modified to suit."

Hills expect that the waiting time for installations will be about two months, depending on orders received from particular areas, and the distances to be travelled from main centres.

The system will prove ideal for remote sheep and cattle stations, mining camps and drilling sites, where a number of TV sets can be connected to it by means of a TV cable system. Hills has many years experience in the planning and installation of TV distributions systems in Australia, and exports many components for these systems to overseas markets.

For further information on the Hills Telesat satellite receiving system, contact Mr Bob Ling, Managing Director, Hills Industries Ltd, 506-508 Guildford Rd, Bayswater, WA 6053; or 7 Ackland St, Edwardstown, SA 5039.



This collecting horn gathers microwave signals reflected from the screen and feeds them to a specially developed low noise amplifier.

Computers — Japan tackles IBM

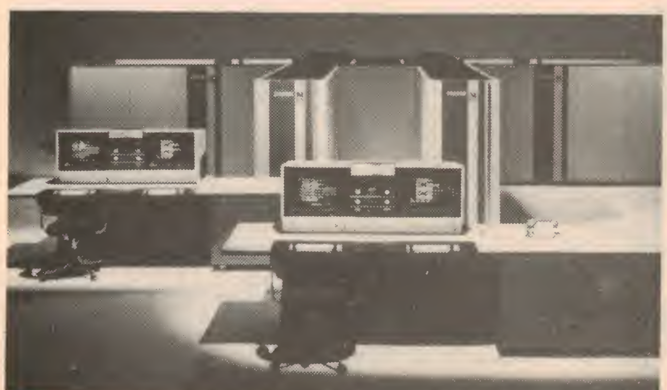
Although still the leader in the world market, IBM (International Business Machines) is facing stiff competition from Japanese computer manufacturers. Are Japanese computer manufacturers poised to do for computers in the 80s what their automobile manufacturers did for cars in the last two decades?

by GENE GREGORY

When IBM introduced the 4300 series of fourth generation computers last year, a primary objective was to check the mounting Japanese thrust into North American and European markets. By opening its new series with small and medium sized systems and an aggressive price-performance strategy, IBM sought to cut into those segments of the Japanese market where domestic makers were strongest. At the same time it was also attempting to pull the rug from under the plug compatible machine (PCM) vendors through which Japanese manufacturers had entered the US and European markets.

With the sudden demise of Itel's computer division, which was marketing Hitachi-made PCM equipment, the effectiveness of IBM's strategy seemed to be confirmed. Wall Street analysts, industry experts and computer users who had foreseen the end of the PCM industry were momentarily heralded as prophets.

But that is not the way things have turned out. In fact, the most severe difficulties of the PCM vendors were suffered before the IBM announcement, when customers were delaying purchasing new computers until it was clear what IBM had to offer. Once the word was out, however, and it became evident that IBM was not in a position to meet the pent-up demand for the more powerful and inexpensive 4300 machines, even those PCM vendors competing directly with the 4300 series became the unintended beneficiaries of IBM's seemingly well-designed strategy.



Facom, a subsidiary of Fujitsu, makes this M-200 system.

By the second quarter of 1980 the PCM industry had recovered from the shock treatment and shipments climbed to an all-time high record. According to International Data Corporation (IDC), deliveries of medium-sized PCM machines in the US market alone surpassed 520 in 1980, which amounted to a very respectable 45% growth rate over the previous year.

Even for those experts most mesmerised by IBM's size and past performance, this was dramatic evidence that there have been some profound changes in the industry. To be sure, IBM's strategy misfired in part because of its "overly-successful" pre-announcement promotions. The flood of orders for the new series pushed back delivery dates by as much as two years, and many customers simply could not afford to wait.

But even more important, for many there was little advantage in waiting for the IBM machines. Fujitsu and Hitachi, the main suppliers of equipment to PCM vendors, more than matched IBM's new performance standards with their own fourth generation models and they were able to meet the stiff price competition.

Significantly, Amdahl Corp, in which Fujitsu has a major stake, did not follow Itel's path to ruin, as some analysts had anticipated. When National Semiconductor took over the sales and service network of Itel to form National Advanced Systems (NAS), Hitachi was assured an even more effective marketing channel for its giant PCM equipment than it had previously. And, while these two firms were consolidating their hold on 12% of the IBM-type equipment market, other PCM suppliers such as Magnuson Computer Systems Inc, Two Pi Corp (a Philips subsidiary), and IPL Systems Inc have been moving rapidly to take advantage of opportunities which are in large part IBM's making.

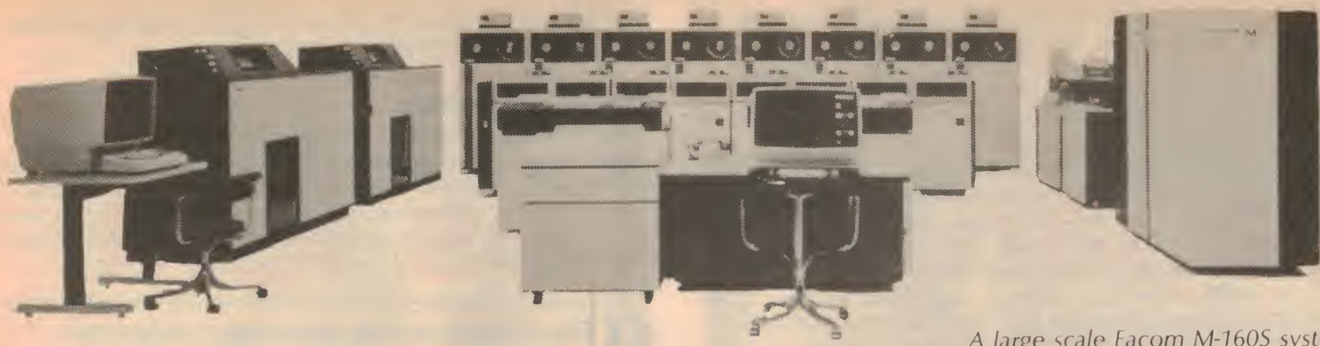
IBM under challenge

For IBM this is not the worst of the bad news, however. If the 4300 strategy failed to eliminate the PCM vendors in the US and other major markets, in Japan it had a near disastrous boomerang effect. Since the announcement of the new series, IBM has continued to lose Japanese market share, dropping from its long-held position of market leadership to second place behind Fujitsu.

Fujitsu's sales have risen steadily in the face of the best IBM could offer, increasing 8% in fiscal 1979 to 326.8 billion yen ($A1.3 billion), while IBM Japan's computer sales in the Japanese market declined for the first time since its founding. Total sales of IBM Japan, including exports to the US parent and affiliates in other markets, were 324.2 billion yen, but domestic computer deliveries accounted for only 267 billion yen, down slightly from 270 billion yen the previous year.

Here again, IBM was the victim of its own strategy. Japanese computer users who might have bought IBM machines were hesitant to make buying decisions because sufficient numbers of the new 4300 series were not available for delivery.

Significantly, IBM Japan decided not to recruit new personnel in fiscal 1980, signalling a major restructuring of the company's business organisation and the introduction of more automated systems in clerical and managerial operations to



A large scale Facom M-160S system.

trim rising manpower costs. During the last three years of the 1970s, IBM Japan's manpower costs reportedly exceeded the growth in revenues and had to be curtailed without breaching the company's life-long employment commitments to its personnel.

In part, IBM Japan's financial problems were a reflection of changes in cash flow resulting from a customer shift from purchasing to leasing computers, a practice which IBM's strategy has itself tended to encourage. But the basic problem runs far deeper than this.

> "All signs suggest that IBM can expect things to get worse and quite possibly never get better"

At least since 1976, IBM has been losing market share not only to Fujitsu, but also to Hitachi and NEC. From 1976 to 1979, Hitachi's computer sales increased by 50% and NEC boosted its data processing revenues by more than 75%, compared with a 25% increase in total IBM turnover.

And there is nothing on the horizon that suggests a reversal of this trend. Quite to the contrary, all signs suggest that IBM can expect things to get worse and possibly never get better.

In November last year, NEC unveiled three new ACOS systems reputed to average 30% to 40% better performance than comparable IBM 4300 series equipment. And, if NEC's experience with the ACOS 250 is any measure of the reception these machines can expect, they spell trouble for IBM. In the seven months following the announcement of the ACOS 250, fully 60% of the 360 orders were from users of other makers' machines or those who had not previously been using computers. At least some of this gain was at IBM's expense.

It is by no means an accident, of course, that the most rapid growth in the Japanese computer market has been recorded by Japan's leading manufacturer of semiconductors and communications equipment. NEC's worldwide lead in memory technology has served it particularly well in computer development in recent years, and its combined strength in integrated circuitry, communications and computers is likely to have important advantages in the future.

Japanese marketing campaign

Indications are that NEC will continue to build its market share not only in Japan but also in foreign computer markets, where it is now mounting an aggressive marketing effort. If all goes according to plan, NEC will increase its computer exports sixfold from an estimated 11.2 billion yen ($A43.7 million) in fiscal 1979 to around 60 billion yen ($A234.3 million) by fiscal 1983. Should this target be met, NEC's exports in that year will almost equal total Japanese computer exports in 1978.

At the same time, Fujitsu is mounting an even more ambitious bid for world markets. From fiscal 1978 computer exports of 34.3 billion yen ($A133.9 million), amounting to 11.3% of the company's total computer sales, Fujitsu increased overseas deliveries to approximately 100 billion yen ($A390.6 million).

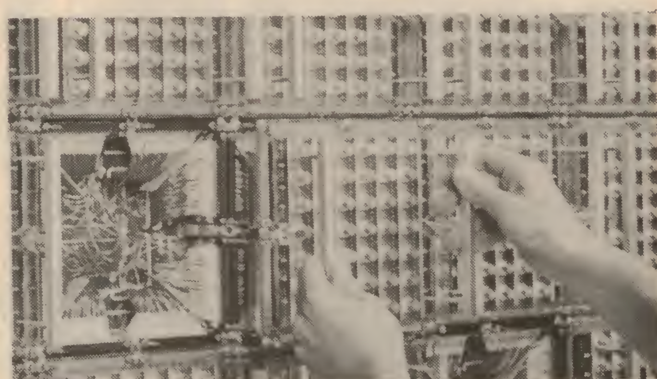
Until now, Fujitsu's major export drive has been in the form of OEM (original equipment manufacturers) supply to computer equipment firms in North America and Europe. Amdahl, in which Fujitsu has a 26.7% shareholding, boosted its purchases of Fujitsu M series computers from 41 units in fiscal 1976 to 110 units in fiscal 1978, taking the leadership in the PCM market. During the same period, Fujitsu supplied Memorex in the US with magnetic disk drives which were marketed under the buyer's brand.

Although Amdahl remains Fujitsu's primary business partner in the American market, and also sells Fujitsu-made PCM computers in Europe through Amdahl International Ltd (a 50-50 joint venture between Amdahl and Fujitsu), in May 1980 Fujitsu announced that agreement had been reached with TRW to establish a separate marketing joint venture in Los Angeles. The new company, TRW-Fujitsu, is 51% owned by Fujitsu with the remaining equity held by the American partner. It has begun marketing a wide variety of peripheral and terminal equipment in addition to small general-purpose computers, becoming the first overseas sales organisation to offer Fujitsu computers under the manufacturer's own brand name.

The logic of the TRW-Fujitsu joint venture is compelling. TRW is able to utilise its existing resources and facilities for marketing and maintenance of aerospace and other electronic systems to sell a complementary line of computer equipment. Fujitsu gains a ready-made marketing organisation for a broad spectrum of its competitive data processing equipment, which is not sold by Amdahl. This at once provides a hedge against the risks inherent in the PCM business with Amdahl and makes Fujitsu's position in the US market less vulnerable to IBM attack.

Sales by the new joint venture got off to an auspicious start soon after its doors were open for business with an order of a computer system consisting of POS terminals and modular store processors from a leading Detroit department store.

Although the main thrust of Fujitsu's present North American strategy is toward building marketing structures, the leading Japanese EDP equipment maker has already established some solid foundations for a major industrial presence.



Each board of this processor circuit contains arrays of Multi Chip Carriers (MCCs), each holding several LSI chips.

Fujitsu America, which distributes semiconductors and other electronic components, already assembles Amdahl computers in San Jose. In Canada, Fujitsu holds a 23.6% share of Consolidated Computer Inc, which it has licensed to produce its terminal equipment. And in the Fall of this year, Fujitsu began semiconductor production in a new two billion yen ($A7.8 million) wholly-owned facility in San Diego, California.

In contrast to this impressive beginning in North America, Fujitsu's presence in the European market is less well-developed. Total EDP equipment sales in Europe have been only a third of those in the United States.

As in North America, Fujitsu's approach to the more fragmented European market has been through organisational links with key partners. To take on IBM and struggling European manufacturers at once in a direct frontal attack on the market would be financially imprudent and politically impossible.

In Spain, Fujitsu has formed a joint venture with INI, the public-sector industrial giant, to manufacture small general-purpose computers under license. Computers and non-impact printers are supplied to Siemens of Germany on an OEM basis, an arrangement which could well be the beginning of a much broader-based industrial co-operation.

Siemens and Fujitsu have a long-standing close relationship which dates back to 1923 when Siemens took a major shareholding in Fujitsu's parent company, Fuji Denki. Much of Fujitsu's original communications technology came from Siemens, and more recently, through Fujitsu Fanuc, the two firms have been closely linked in the marketing of numerical control equipment in European markets.

"IBM's strength lies in its global structure, and Japanese computer makers recognise that they cannot challenge that structure alone"

As in the US, while Fujitsu has opted for co-operative strategies in entering the European numerical control and computer markets, it has decided to go it alone in semiconductors, with a new, wholly-owned manufacturing facility to begin operation in Ireland sometime next year. Both European firms and Fujitsu have found common ground for co-operative ventures designed to chisel away at the pre-dominant position of IBM in Continental markets. The competitive environment of the semiconductor industry in Europe has also been more conducive to Japanese investment in wholly-owned manufacturing ventures, just as it has been in North America.

Meanwhile, Hitachi is following the route taken by Fujitsu in the US and European markets. Large computers are supplied to NAS, which has non-exclusive marketing rights in world markets. Basically the same equipment, an advanced version of the powerful Hitachi M200H, has also been offered to Olivetti and BASF for marketing under their respective trade marks.

Since the Hitachi machine is IBM compatible, these arrangements enable all three firms to compete with IBM in this segment of the market. And since the new Hitachi computer is probably the most powerful of its kind now available, each of the three firms is confident that they can generate substantial sales.

Olivetti, the first to sell a giant Hitachi machine in Europe, expects to install 30 in the next two years. NAS is even more sanguine. With 170 computers already installed in Europe, a base acquired from Itel, NAS Europe estimates that the market for machines of this size could well be 150-200 in the next two years. And through its multi-channelled approach to the European market, Hitachi stands a good chance of supplying a significant share of that demand.

As yet, Hitachi has not made a concerted bid for other segments of the US and European computer markets. Chances are that when it does, it will opt for joint ventures or further OEM supply arrangements in both markets.

Global strategies

All Japanese computer makers, including about 20 manufacturers of small business computers, recognise that survival in this industry ultimately depends on strength in world markets. Still, at present, exports amount to only about 8% of total sales by the Japanese industry, compared to approximately 50% for the automobile industry and 42% for colour television.

"The impact of the Japanese computer industry on world markets might well be as great as in the 1980s and 1990s as that of the Japanese automotive industry in the past two decades"

In some respects' Japan's computer industry today stands at the same take-off point reached by its automotive industry in 1965. But in some very important ways the computer industry is in a much stronger position for global expansion than the automotive industry was at that time.

Japanese computer manufacturers are better organised and financially stronger than Japanese automobile manufacturers were in 1965. Even more important, compared with the competition, Japanese computer makers are also relatively stronger technologically than were the car manufacturers in that earlier period.

It is reasonable to expect, therefore, that the impact of the Japanese computer industry on world markets might well be as great in the 1980s and 1990s as that of the Japanese automotive industry in the past two decades.

The main difference is likely to be in the strategies of Japanese computer makers. MITI policy-makers, as well as corporate strategists, have clearly opted for co-operative modes of global expansion, developing major markets jointly with leading foreign manufacturers and vendors.

To be sure, IBM's pre-eminence in world markets makes this approach imperative. IBM's strength lies in its global structure, and Japanese computer makers recognise that they cannot challenge that structure alone.

But it is also true that there is a growing realisation in Japan that the nature of the global village in an information age calls for co-operative arrangements to reduce tensions and assure the best use of advanced technologies.

Computer Sales by Major Manufacturers in Japan (1976-1979)
(billions of yen)
(there are approximately 256 yen to $A1.00)

	1976	1977	1978	1979
Fujitsu	239.6	274.5	303.0	326.8
IBM Japan	275.4	293.8	315.3	324.2
Hitachi	142.0	160.0	190.0	216.0
NEC	114.0	137.5	166.8	200.7
Nippon Univac	70.6	67.8	71.6	73.6
Oki	48.3	44.4	47.9	62.8
Mitsubishi	32.0	38.0	45.0	53.0
Toshiba	59.2	59.1	43.0	50.4

Source: Nihon Keizai Shimbun

Footnote: In April, Facom Australia, the Australian subsidiary of Fujitsu, announced that it had made hardware and software sales worth more than $40 million during 1980. National sales manager John Linton said that 1980 had been "a staggeringly successful year". Sales included a total of 47 M-series CPUs, the "top-of-the-line" Facom mainframe. Of these sales, an estimated 37 displaced competitor's equipment, with IBM and ICL suffering the main losses.

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The Pet communicates in BASIC— the easiest computer language. Easy to learn and easy to use, BASIC has now become the standard for personal computers, with literally thousands of programmes available. The PET is also programmable in machine language, allowing more efficient use of the system.

The full-size keyboard is capable of producing letters, numbers and graphic symbols. Upper and lower case is standard. Characters appear on the screen in a pleasant green colour designed to reduce eye fatigue and may be displayed in normal or reverse print.

PET's IEEE-488 Bus- just like H.P.'s mini and full size computers — permits direct connection to over 200 pieces of compatible equipment such as counters, timers, spectrum analysers, digital voltmeters and printer plotters from H.P., Philips, Fluke, Textronix and others.

The full range of Commodore Disk Drives and Printers are plug-compatible with the PET and a comprehensive range of cassette and disk based programmes are available through the extensive network of Commodore Dealers.

APPLICATIONS

The Commodore PET is a creature of many faces. Its applications are limited only by the user's imagination.

The future of the PET is virtually unlimited; its present capabilities are already many and impressive. As a personal computer, the PET can teach languages and mathematics; play games; create graphic designs; store meal recipes and change number of portions; maintain budgets, personal records and checkbooks; operate appliances and temperature controls.

As a management tool, it delivers the information the executive needs, in the form he can use, and available to him alone. Trend analyses charts and graphs can be almost instantly available.

The professional may use the PET for maintaining appointment schedules, recording income and expenditures and filing all the specialized information and forms he may need to make his work more efficient — from medical records for a doctor to income tax computations for an accountant.

The engineer, mathematician, physicist, has a tool far superior to the very best programmable calculators yet developed... at a cost that is comparable...and with almost infinitely greater versatility.

And the businessman has a computer that can maintain inventories, keep payroll records, operate accounts payable and receivables, issue cheques and handle correspondence.

Commodore PET 4016 Computer Technical Specifications.

Computer/Memory

Read/Write Memory (RAM) 16K bytes available to the user

Read Only Memory (ROM) 14K bytes in total, divided into:

8K BASIC interpreter available immediately you turn on your PET,

5K Operating System

1K Test Routine

The 6502 micro-processor chip makes the PET one of the fastest and most flexible BASIC systems. Significant features of Commodore BASIC are:

- 960 simple variables
- 960 integers
- 960 string variables
- 960 multi-dimensional array fields for the above 3 types of variables
- Up to 80 characters per program line with several statements per line
- Upper/Lower case characters and graphics capability
- Built in clock
- 9-digit floating point binary arithmetic
- True random number generator
- Supports multiple languages; machine language accessibility

Keyboard

74-Key professional keyboard.

Separate calculator/numeric pad.

Upper-case alphabetical characters with shift key to give 64 graphics characters.

Can be set for lower case and shifted upper case characters.

Screen

40 characters wide by 25 lines (1000 characters in 8 × 8 dot matrix).

23 cm screen phosphor screen

Brightness control.

64 ASCII plus 64 graphics characters

Blinking cursor with full cursor control, including programmable control

Screen editing capabilities

Full cursor control (up, down, left, right)

Character insert and delete

Reverse character field

Overstriking

Return key sends the entire line to the CPU regardless of cursor position.

Input/Output

8 bit parallel input/output port

IEEE-488 Bus (HP-IB and IEC Bus) allows up to 12 other peripherals to be connected

Two cassette ports.

Video signals for additional displays

Serial output port.

Technical Data

Dimensions Height 355 mm (14"), Width 419 mm (16.5"), Depth 185 mm (18.5"), Shipping Weight 20.9 kg (46 lbs)

Power requirements 240V ± 10%, Frequency 50 Hz, Power 100 Watts

Commodore BASIC

APPEND	GOSUB..RETURN	STOP	SPC
BACKUP	IF..THEN	SYS	LEFT$
CLOSE	INPUT	VERIFY	RIGHT$
CLR	INPUT #	WAIT	MID$
CMD	LET		CHR$
COLLECT	LIST	SGN	ASC
CONCAT	LOAD	INT	LEN
CONT	NEW	ABS	VAL
COPY	ON..GOSUB	SQR	STR$
DATA	OPEN	SIN	TI
	POKE	COS	TI$
DEF/FN	PRWT	TAN	ST
DIM	READ	ATN	DS
DIRECTORY	RECORD	LOG	DS$
DLOAD	REM	EXP	+
DOPEN	RENAME	AND	—
DSAVE	RESTORE	OR	*
END	RUN	NOT	/
FOR/NEXT	SAVE	TAB	↑
GET	SCRATCH	POS	π

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THE GREEK GODS

MGM's "Clash of The Titans" is an excursion into Greek mythology based on the legend of Perseus and Andromeda. Filmed on location in four countries, the film boasts a glittering cast of human stars and an assortment of monsters and strange beings, brought to life for the screen with animation, radio control and scale models.

The gods of ancient Greece were immortal. Endowed with supernatural powers they breathed the rarefied air of Mount Olympus, lived on ambrosia and nectar, and were worshipped by the mortals who dwelt on the plains below and built temples to their honour.

Love and charity were not necessarily part of the lives of these super-beings. They frequently appeared all too human – benevolent to their friends, vengeful of slights, contrary and bawdy as they fought for power and pursued their own selfish aims.

To be Perseus, son of Zeus, could be considered a favoured position for any man, but not when your father's philandering has upset a clutch of gods as powerful as Hera, Athene, Thetis and Aphrodite. Perseus was to experience all the vagaries of the humour and temper of the gods.

Metro-Goldwyn-Mayer's "Clash of The Titans" tells of Perseus' battles to win the hand of the beautiful Andromeda. The gods look down and help and hinder according to their whims as Perseus, aided by Pegasus the winged horse and Bubo, an automated owl, overcomes the three Stygian witches; a monstrous two-headed dog; Dioskilos; Medusa; and ultimately the Kraken, a giant monster which rises from the sea-bed to bring destruction to the cities of ancient Greece.

"Clash of The Titans" is an exciting blend of live action and visual effects filmed in "Dynarama", a process developed by the film's co-producer and creator of special effects, Ray Harryhausen. The film is the most ambitious project ever undertaken by producer Charles H. Schneer and collaborator Harryhausen.

Banished from his kingdom and punished by the gods of Mt Olympus, Calibos longs for the beautiful princess Andromeda in MGM's "Clash of The Titans".

Ray Harryhausen has made dinosaurs walk the earth, horses fly, statues come to life, apes play chess and skeletons fight, to the delight of film audiences all over the world. Harryhausen calls his work "kinetic sculpture" – a method of stop-motion filming that has made him an outstanding figure in the cinema world.

Each of the animals he creates has its own problems. "I've worked with a seven-headed hydra", says Harryhausen, "so a two-headed dog is comparatively easy, although there are complications. The dog has to play a very active part in a fight where it loses a head".

Harryhausen has built a reputation and a cult following as an expert in the use of stop-motion film techniques, and "Clash of The Titans" is his 16th film. With exact scale models and stop motion photography, each frame of a critical scene is shot separately, with the models moved a fraction between each frame. When shown at normal projection speed the effect is startlingly real, but long hours of planning and work go into each short segment.

In past films, his creatures have included an octopus which devoured San Francisco's Golden Gate bridge, fighting skeletons and flying furies and a host of appealing and appalling creatures. His talents have been given full reign in "Clash of The Titans". There is the magical owl Bubo, forged by the blacksmith Hephaestus at Athene's command, who leads Perseus to the lair of the Stygian witches, and when Perseus ultimately stands against the monstrous Kraken it is Bubo who saves the day.

Pegasus, the pure white flying horse, is captured by Perseus at the Wells of the Moon, and carries him into battle against the Kraken. Another character, Calibos, was once a handsome youth but is now an odious mutation, half human and half satyr. Cursed by Zeus, Calibos has one cloven hoof, a reptilian tail, claws and horns, and lives in a swamp crawling

make . . .

LIVE AGAIN

At right, Perseus stands triumphant after defeating the hideous Medusa.

with bizarre creatures. Jealous of Perseus, Calibos sends a giant vulture to carry off Andromeda in a gilded cage, to be rescued, of course, by the hero.

There are various techniques for making the monsters, but they are all based on Harryhausen's initial ideas and detailed sketches. The animated models are all built on a very small scale and require extensive preparation. Internally the models are complex, much more than wire and sponge rubber. The arms of the creatures, for example, have machined ball and socket joints at each location a real animal would have joints. Sometimes it may take months to get all the "characters" functioning properly.

The human stars of the show could be over-shadowed by the technical wizardry of special effects, but with talents like Sir Laurence Olivier as Zeus and Ursula Andress as Aphrodite, the Goddess of Love, this is unlikely. Harry Hamlin, who plays the hero Perseus, is a graduate in theatre and psychology from Yale University, and has recently been cast in the lead role in the mini-series "Studs Lonigan".

Judi Bowker plays Andromeda. With no formal training, Ms Bowker made her first film appearance as Sister Clare in Zeffirelli's "Brother Sun, Sister Moon", when she was 16 years old. Since then she has starred in the television series "Black Beauty" and "South Riding". With Britain's National Theatre she has appeared in productions of "Macbeth" and "The Cherry Orchard".

"Clash of The Titans" was filmed on location at some of the most historic sites in Europe. In Southern Italy the temples of Paestum, which date back to the 7th century before Christ, the deserted beaches of Palinuro and the ancient amphitheatre at Ostia Antica have become the playground of the gods. The caves and rocky shores of Malta and the spectacular scenery of Gaudix and Antequerra in Spain also serve as the background for epic scenes.

Mount Olympus, the interior of the Temple of Thetis, and the Palace of Cassiopea were constructed at Pinewood Studios, London, using the largest sound stage in the world.

The film will be released Australia-wide on August 21st, being screened initially in the capital cities.

Stars of the show are Judi Bowker as princess Andromeda and Harry Hamlin (Perseus).

New transmission technique for amateurs

Amateur radio throughout the world thrives on experimentation. This article from the United States describes the spread spectrum (SS) modulation technique, which is attracting increasing interest from amateurs in that country. Spread spectrum modulation promises a more efficient use of present radio frequencies and a reduction of interference on the crowded amateur bands.

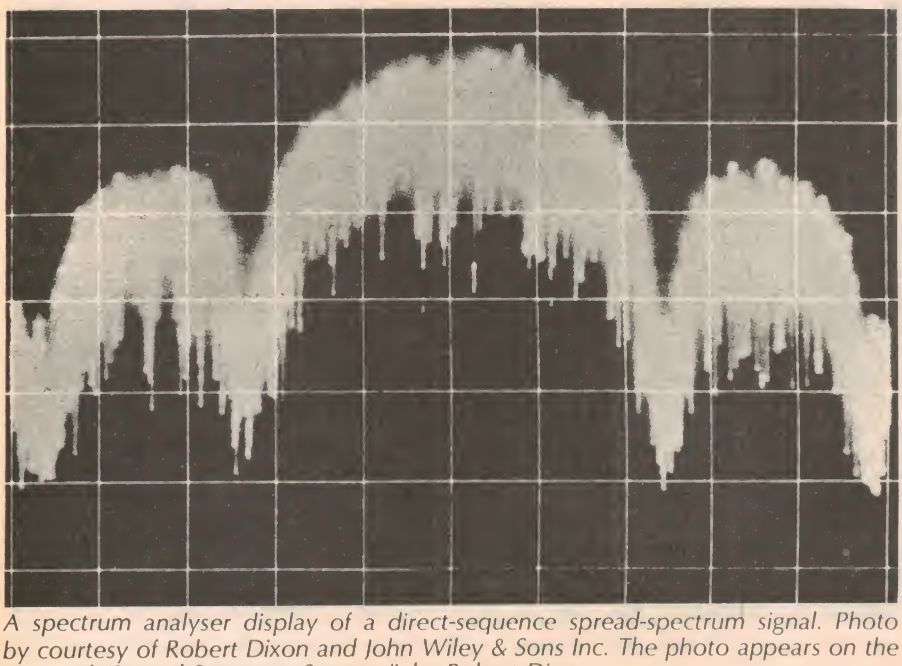
by PAUL L. RINALDO

A modulation technique that has been in development since the late 1940s, spread spectrum (SS) has, until recently, been virtually unthinkable for use by radio amateurs for a number of reasons. First, SS occupies bandwidths far in excess of the prescribed bands; that would be illegal! By using a pseudo-random digital sequence to scatter energy over a wide band, there is only a small amount of energy in any one hertz; that would make it an unauthorised code. SS systems have been complex and expensive; that would be beyond the resources of radio amateurs. Much of the development has been conducted under government contract; most amateurs knew little or nothing about the subject. These were more than enough reasons to deter amateurs from even dreaming about an SS rig in their shacks.

The situation has changed greatly in recent years! SS technology has progressed to the point where affordable systems can be built for amateur and other non-governmental uses. In the US, the replacement of the Federal Communications Commission's Office of the Chief Engineer with the Office of Science and Technology (OST) carried with it the mandate to encourage the use of new technology. The FCC's OST sees the Amateur Radio Service as a test bed for new techniques. Some at the FCC feel that the long-term retention of amateur frequencies in competition with other radio services depends largely on contined technological advances by amateurs. We may be entering an "experiment or expire" era.

Why the sudden interest in SS? The reasons are many. First, there is the simple technical imperative, meaning that the technology is there as a result of many years of government-sponsored development, so why not use it for civilian applications? Another reason is that a number of SS users, say in the Land Mobile Service, could be overlaid on top of an existing band already "full" of mobile users employing conventional frequency modulation. Similar overlays could be tried by amateur experimenters. If this is done with care, the existing users wouldn't even detect the presence of the SS overlay.

Yet another possibility is the creation of new bands, maybe a 900MHz band, which would use SS exclusively to accommodate thousands of users. Moreover, SS could afford these users both privacy and immunity from interference through proper code settings. In general, SS offers possibilities for more extensive sharing of frequencies while minimising interference.



A spectrum analyser display of a direct-sequence spread-spectrum signal. Photo by courtesy of Robert Dixon and John Wiley & Sons Inc. The photo appears on the cover of "Spread Spectrum Systems", by Robert Dixon.

Spread-Spectrum Fundamentals

SS systems employ radio-frequency bandwidths that greatly exceed the bandwidth necessary to convey the information. Bandwidths for SS systems generally run from 10 to 100 times the information rate. By spreading the power over a wide band, the amount of energy in any particular hertz or kilohertz is very much smaller than for conventional narrow-band modulation techniques. Depending upon the transmitter power level and the distance from the transmitter to the receiver, the SS signal may be below the noise level.

SS systems also use coding sequences to modulate and demodulate the transmission. Receivers with the wrong code will not demodulate the encoded SS signal and will be highly immune to interference from it. On the other hand, receivers with the right code are able to add all the spread energy in a constructive way to reproduce the intended modulation. Changing the code to another sequence effectively creates a new "channel" on which a private conversation can take place. Many good code combinations could be made available on a single chip and selected by means of thumbwheel switches on the SS transceiver.

Types of Spread Spectrum

There are four basic types of spread spectrum: direct sequence, frequency hopping, pulse-FM and time hopping. In

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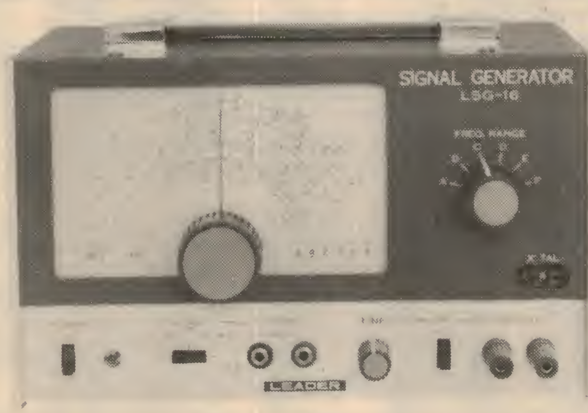

Frequency Range:
(A) 100 kHz-320 kHz;
(B) 320 kHz-1100 kHz;
(C) 1.0 mHz-3.3 mHz;
(D) 3.2 mHz-11 mHz;
(E) 10 mHz-35 mHz;
(F) 30 mHz-100 mHz.
Harmonics: 90 mHz-300 mHz. **Accuracy:** ± 1.5% **Output:** 0.1 Vrms or higher to 100 mHz. **Modulation:** Internal: 1 kHz, External: 50 Hz to 20 kHz **Size and Weight:** 150(H) x 250(W) x 130(D). 2.5 kg approx.

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Input impedance: 20,000 ohms per volt **Range:** 40,000 volts **Accuracy:** ± 3% full scale. **Length & Weight:** 385 mm 300 g approx.

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Leader's Dip Meter–

Almost essential if you're into Ham, CB or other communications operation. Determines IC network frequency resonance and can be used to adjust wave traps, find parasitic oscillations and align receivers.

Frequency Range: 1.5 to 250 mHz in 6 bands. **Power supply:** 9V battery. **Oscillator:** Uses 1.15 mHz crustal **Semiconductor complement:** 2 transistors and 1 diode. **Size and Weight:** 175(H) x 65(W) x 50(D). 0.5 kg approx.

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addition, there are hybrids consisting of combinations of two or more of the above basic types.

Direct Sequence (DS): Direct sequence SS is produced by modulation of a carrier with a digitised code stream. This type of modulation is also known by the terms pseudo-noise (PN), phase hopping (PH), direct spread, or direct code. Phase-shift keying (psk) is usually used to produce the marks and spaces, but frequency-shift keying (fsk) could also be used. The wide RF bandwidth arises from the use of a high-speed code. Of course, if the transmitter were allowed to rest on the mark frequency, there would be a steady carrier in one place whenever there is no modulation. This would produce interference to a narrow-band user on that frequency. It would also pose problems for other SS users of the same band, particularly if they did the same thing. So it is conventional for SS systems to include techniques to continue a pseudo-random code sequence even during intervals when intelligence is not being transmitted.

The power spectrum for a DS signal (as might be seen on a spectrum analyser) is not uniform across the band, but has a main lobe and sets of sidelobes as illustrated in Fig. 1. The bandwidth of the main lobe as measured from null to null is two times the clock rate of the code sequence. The bandwidth of the side lobes is equal to the clock rate. To receive a DS signal, the receiver must collapse or "despread" it to the original bandwidth of the information. This is done by using a replica of the code sequence used by the transmitter.

Frequency Hopping (FH): As the name implies, frequency hopping is simply jumping to a number of different frequencies in an agreed sequence. The code sequence is usually at a slower rate than for direct sequence and is normally slower than the information rate. The hopping rate may also be determined by practical considerations, such as how long it takes for a particular frequency synthesiser to settle down on a new frequency.

Actual modulation of the frequencies uses normal narrow-band techniques such as frequency modulation. At any instant, an FH transmitter is emitting all of its power on a specific frequency slot and potentially could interfere with someone else using a narrow-band system on that frequency. However, the FH dwell time on that particular frequency is so short that most narrow-band users would not be bothered. Mutual interference between two or more FH users sharing the same band could be extremely low, depending upon the design of the code sequences. Fig. 2 illustrates the power spectrum for an FH signal.

Pulse-FM (Chirp): A chirp spread-spectrum system sweeps its carrier frequency over a wide band at a known rate. Again, conventional narrow-band modulation of the sweeping carrier is used to convey the intelligence. The receiver uses a matched, dispersive filter to compress the signal to a narrow band. Chirp systems typically do not use a code sequence to control the sweep generator. Sweep time can be largely independent of the information rate. Normally, a linear-sweep pulse is used, similar to that produced by a sweep generator. The power spectrum for a chirp system is illustrated in Fig. 3.

Time Hopping (TH): Time hopping is a form of pulse modulation using a code sequence to control the pulse. As in other pulse techniques, the transmitter is not on full time and can have a duty cycle of 50% or less. Several systems can share the same channel and function as a time-division multiple-access (TDMA) system. TH is more vulnerable to interference on its centre frequency than other SS systems. Seldom seen in its pure form, TH is typically used in hybrid systems using frequency hopping as well.

Hybrids: In addition to the TH/FH hybrid system just mentioned, there are also DS/FH and DS/TH combinations. Hybrid systems are typically designed to accommodate a large number of users and to provide a higher immunity to interference. They also produce better results at practical code sequence rates governed, for example, by how fast a frequency synthesiser can be switched. Also, hybrids can produce greater spreads than those which are practical for pure SS systems.

Considerations in the use of SS

Synchronisation: In the design of a spread-spectrum system, usually the toughest problem is synchronisation of the code sequence at the receiver with that of the incoming signal. If sync is not attained, even just one bit off, nothing but noise can be heard. The problem becomes worse when more than two stations are trying to communicate in a net. This is because of the different propagation delays between stations; ie, it takes a different time for a signal to travel over paths A-B, A-C, or B-C if the stations are not equidistant. These differences may be only slight but just enough to degrade the signal-to-noise ratio of the received signal. In addition to the time uncertainty related to propagation, there is also a frequency uncertainty in trying to keep oscillators at two or more stations from drifting.

Because the stations cannot be expected to synchronise on their own with no reference, it is normal for at least one station to transmit an initial reference for sync purposes. Upon reception, the receiving stations can generate the code sequence at a rate different from the code sequence used at the transmitter. Eventually, the two code streams will slide into phase with one another and may then be locked up. After initial synchronisation, maintaining sync presents another problem which can be solved in different ways. One is to use a code sequence preamble at the beginning of each transmission. Another is to use ultra-stable clocks at all stations to ensure that the code-sequence clock frequency does not change. Numerous other schemes have been devised and implemented with varying degrees of difficulty. The exception is that chirp systems do not have this problem because the matched filter used in demodulation inherently achieves sync on each pulse transmitted.

Transmitter and Receiver Design: One difference between SS and conventional RF equipment is that SS requires transmitters and receivers that have 10 to 100 times the bandwidth of narrow-band systems. That may pose some problems at lower frequencies, but in the 420MHz band the amateur television (ATV) experimenters already have equipment that can handle wideband signals. The transmitter design, which should be well within amateur capability, amounts to taking care in broadbanding the RF stages after modulation to maintain

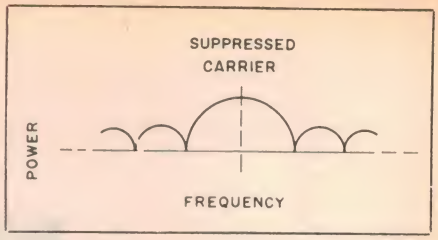

Fig. 1: Power vs frequency for a direct-sequence-modulated spread-spectrum signal. The envelope assumes the shape of a (sin x/x)² curve. With the proper modulating techniques the carrier is suppressed.

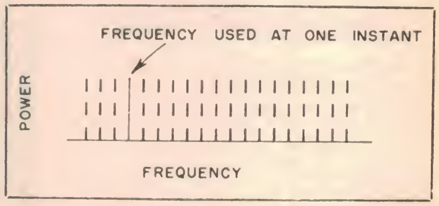

Fig. 2: Power vs fequency for frequency-hopping spread-spectrum signals. Emissions jump around in pseudo-random fashion between discrete frequencies.

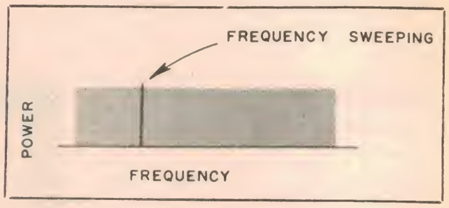

Fig. 3: Power vs frequency for chirp spread-spectrum signals. The carrier is repeatedly swept from one end to the other of a given band.

amplitude linearity, and in keeping the antenna system VSWR very low. Receivers must not only have wideband front ends but must have good dynamic range and linearity to handle both the desired signal and any interference. Where an IF stage is used, the frequency chosen must be higher than for conventional transceivers. In practice, 70MHz is a common SS IF. Components (such as filters) are available for this frequency to build SS IF modems (modulator/demodulators).

Amateur SS in the United States

The Amateur Radio Research and Development Corporation (AMRAD) has formed a group to experiment with several different types of SS systems. Before on-the-air tests are conducted, it will be necessary to obtain a Special Temporary Authorisation (STA) from the FCC.

The continued existence of the Amateur Radio Service depends, in part, on amateurs' contributions to the state of the art through experimentation. Spread spectrum is fertile ground for amateur investigation. While SS has been developed extensively for military and other governmental applications, civil uses are virtually unexplored. Amateurs have the capacity to build SS systems which are practical and inexpensive. There is no guarantee that SS will prove itself worthy of regular use in civilian radio services, but the technology is ripe for amateur radio experimentation.

Glossary of Spread Spectrum Terms

Chirp — Same as pulse-FM.

Code sequence — A series of 1 or 0 bits arranged in a known pattern.

Direct code — Same as direct sequence.

Direct sequence — A type of spread-spectrum modulation using a code sequence to modulate a carrier, normally using phase-shift keying.

Direct spread — Same as direct sequence.

Frequency hopping — A type of spread spectrum which employs rapid switching between a large number of discrete frequencies.

Hybrid — A spread spectrum system that combines two or more basic types of spread spectrum.

Phase hopping — Same as direct sequence.

Pseudo-noise — Same as direct sequence.

Pulse-FM — A type of spread spectrum that uses a swept carrier.

Spread spectrum — A class of modulation types that produce bandwidths far in excess of the bandwidth necessary to convey the intelligence.

Time hopping — A type of spread spectrum using a form of pulse modulation in which the pulses are controlled by a code sequence.

---

50 & 25 YEARS AGO

Wireless Weekly 3d

August, 1931

New equipment for "W.W." laboratory: The latest meter added to the collection in the "Wireless Weekly" laboratory is a Weston output meter. This meter is actually an AC voltmeter, having multi ranges, from 1.5 to 150 volts. Its chief feature, however, lies in its resistance, which is 4000 ohms, and is constant for all ranges. The output meter is to be used for measuring the comparative sensitivity and selectivity of receivers, also the undistorted output and hum level. Whilst for the present there is no intention to change our individual system of testing receivers submitted for test, the new output meter will be a useful instrument to back up instinctive impressions with solid facts.

☆ ☆ ☆

Colonies not keen about Empire Broadcasting: "A year or two ago," continues that foremost authority, "there was a general feeling in this country that an Empire broadcasting service should be pushed forward with all possible speed, but after negotiations had been established between the home Government, the colonies, and the BBC to discuss the matter, the response from overseas has proved somewhat disappointing, and the eagerness of the colonies to participate in an Empire broadcasting service does not seem sufficiently keen to inspire an overwhelming desire on their part to contribute towards the necessary expenses."

☆ ☆ ☆

In July, Japan exchanged shortwave programs with America. The Japanese program was of Japanese music and a speech by the Premier, who didn't turn up; and this was relayed by the American long-wave stations to listeners throughout the country. The American program was 10 minutes of American patriotic airs. It is a pity that Mr. Brown can't arrange something similar for Australia. During the first half of this year America has heard 45 broadcasts from 12 cities in eight European countries; the speakers including the Prince of Wales, the Pope, the Presidents of Austria and the Irish Free State, Mr Ramsay Macdonald, the Foreign Minister of Poland, Mr Bernard Shaw and Mr Edgar Wallace. Both the English Houses of Parliament have been represented on the air to American listeners by prominent members, including the Archbishop of York; and many talks on international relations have crossed the Atlantic.

☆ ☆ ☆

A man who lived near the Croydon Aerodrome in England was annoyed one afternoon by a plane which was stunting over his house, whereupon, he rang up the aerodrome and a few minutes later the stunting ceased. The authorities had reproved the offending pilot by wireless.

☆ ☆ ☆

Yet another valve: For about the fourth time in the past month the trade has been startled by the introduction of new valves of amazing characteristics. This time it is the Cossor people again with a radio frequency pentode called the MS-Pen-A. This valve is primarily intended for a radio frequency amplifier with a screen potential of 150 volts. Owing to its remarkably low AC resistance of 80,000 ohms and its good slope of 4 and amplification factor of 320, it should result in greatly improved sensitivity of small receivers. The other surprise that comes with this valve is a new type called a 41MHL, being a triode valve with an amplification factor of 52 and a mutual conductance rated at 4.5mA per volt. Both valves have truly remarkable characteristics and open up big fields for experimental work, and must ultimately improve the overall performance of receivers. Needless to add, our Technical Staff is hard at work picking out the best points of the many fine valves now available.

RADIO TELEVISION AND HOBBIES 1/6

August, 1956

New car sets use transistors: Ever since Bell Laboratories announced their first transistor eight years ago, electronic engineers have been intrigued by its possibilities in car radios. But while there has been much talk in this direction through the years, no manufacturer made a positive move towards transistors until just recently.

Chrysler Corporation in America were first. They announced an all-transistor radio as standard equipment in the new "Imperial". Since then, other manufacturers have followed suit. General Motors have a hybrid set, using both transistors and valves. American Motors have a similar unit and Ford are installing both transistor and printed-circuit radio sets in production cars on an experimental basis.

Manufacturers and independent sources agree that even the early model all-transistor sets have proved their supremacy over conventional units. The advantages are: 33% more power with less distortion; no warm-up period and no vibrator buzz; approximately one-twelfth current drain; 12-volt operation instead of a high-voltage power supply; smaller, lighter sets with a considerable price reduction in sight.

At the present time, the production cost of transistors is high enough to offset most of their advantages. But the industry is keenly aware that, as soon as output of the semiconductors approaches the present output of electron tubes, the price will fall drastically.

It is too early as yet to say that the day of the familiar vacuum tube has passed, although some claim that transistors will eventually replace an estimated 75% of all tubes now used in the many-sided field of electronics. The fact is, that transistor development is still in its infancy and no one can accurately foretell just what will be achieved eventually.

☆ ☆ ☆

UHF controls power stations: A chain of ultra high frequency radio transmitters using 150ft high steel towers is being established by the Electricity Commission of NSW for the remote control of major metropolitan sub-stations.

This is part of an extensive system of communications, remote switching, and supervision of power stations and substations, which is being set up to control the Commission's interconnected system.

Remote switching of substations and interconnectors will be decentralised, being carried out at the Sydney centre (for the metropolitan area), and at the important regional control centres at Newcastle (northern region), Goulburn (southern region), and ultimately Orange (western region).

The electric Power Transmission Co is under contract for the erection of the first nine towers in the metropolitan area, and American RCA radio equipment has been supplied through AWA for installation on each tower as it is completed. The carrier channel apparatus has been contracted for by STC who are making it locally.

☆ ☆ ☆

Australian TV picture tubes: Television picture tubes are in the news these days and Australian valve manufacturers are busily preparing for local mass production. By courtesy of Amalgamated Wireless Valve Co we were recently privileged to watch production of these intriguing devices.

At the time we made our inspection the AWV engineers emphasised that what we were seeing was only a "pilot" run; a production line on a small scale; more concerned with developing techniques, overcoming problems and establishing standards than with producing large quantities.

The tubes we saw were 17in (diagonal) types, having aluminised screens and electrostatic focusing, the latest in picture tube techniques.

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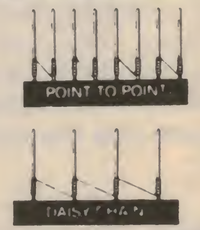

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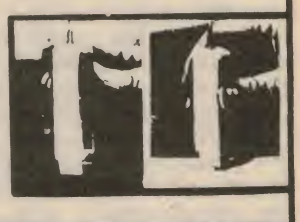

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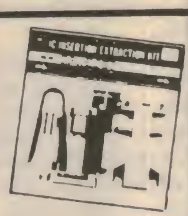

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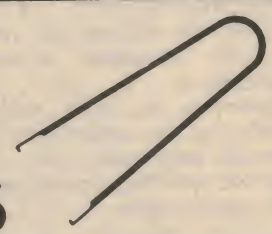

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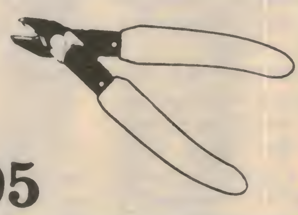

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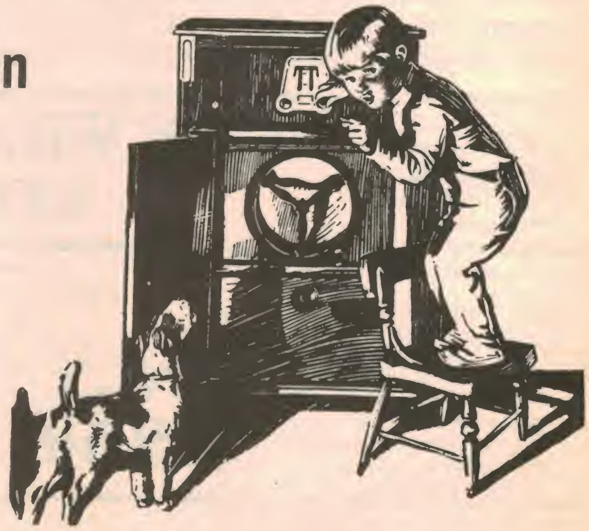


Digitally mastered discs are not a technical achievement, according to some critics but, rather, a giant step backward. How can they be anything else, they say, when they produce subtle forms of distortion and, even worse, an insidious feeling of tension which defeats any pleasure that the music might otherwise bring? .

Allegedly, the problem arises from the fact that the listener is not responding to a continuous (or analog) sound pressure curve as he/she would in the natural way, but to fifty thousand bits of sound per second – a kind of acoustic vibration; a supersonic jack hammer!

The claim can be disturbing because, at first glance, it seems not unreasonable to question the psychological effect and the ultimate fidelity of an audio signal reconstituted from fifty thousand discrete bits per second – and omitting the fifty thousand missing bits in between!

However, as often happens, what seems to be superficially reasonable does not stand up to closer examination. First off, the idea of a digitally mastered disc producing a barrage of bits at a supersonic frequency is entirely false. What comes off a digitally mastered disc, or a digitally mastered cassette is an audio signal; nothing more and nothing less! Let me explain:

DIGITAL TO ANALOG

When producing a consumer analog recording from a digital master tape, the signal passes directly into a D/A (Digital to Analog) converter, which does exactly what its name implies. It accepts digitally encoded information and produces the appropriate analog output signal.

An essential part of a D/A converter for hifi audio is a filter system cutting off sharply above about 20kHz. This passes the reconstituted audio components below 20kHz, but blocks everything else, including energy at the sampling frequency.

What it does, in effect, is to produce a contour which very closely approximates the original audio signal. In fact, measurable distortion is much lower than with any analog tape mastering system. And, because of the 20kHz (approx) cut-off, there is no way that the signal can contain upward spikes equivalent to the original 50kHz samples, or downward spikes equivalent to the spaces in between.

In any case, the signal from that point on has to pass through a whole chain of analog audio processes, which would tend to discriminate against any residual supersonic content: disc processing and processing, or cassette dubbing; the consumer's phono cartridge or tape replay head; the amplifier chain; a loudspeaker system; a pair of ears which cut off at about 15kHz for the average, youngish adult – and at progressively lower frequencies for the not so young.

Hence my earlier statement that the concept of being subjected to a barrage of supersonic bits is a complete fiction. But what of the subtle distortions or inadequacies inherent in a digital system?

Technically, it is not possible to identify any such inadequacies on the basis of present-day methods and expectations. In terms of frequency response, distortion, intermodulation, wow and flutter, signal/noise ratio, ruggedness, etc, a digital master is equal to or way ahead of all practical analog alternatives.

The problem is that some critics of the digital system tend to reject statements about extended frequency response and extremely low distortion as some kind of test bench illusion. How can you possibly describe a signal at 20kHz with a mere 2½ digital samples per cycle?

Unfortunately, there is a considerable credibility gap between the intuitive impression and what actually happens – or what is clearly laid down by sampling and information theory. As quoted in the ITT Reference Data For Engineers (sixth edition, page 41-13), the sampling theorem states:

If a function of time f(t) contains no frequencies higher than W hertz, it is completely determined by giving the value of the function at a series of points spaced 1/2W seconds apart.

Reduced to a more familar form, this boils down to the ofter-repeated truism that, in a pulse coded audio system, the sampling rate must be at least twice the highest signal frequency which it is desired to record and reproduce. Alternatively, the highest available signal frequency will be about half the sampling rate.

But persistent critics find sampling theorems no more convincing than measured results. In the most forthright manner, they assert that they can hear the imperfections, books and instruments notwithstanding!

And what can you say in reply? If you question their veracity, you get a punch on the jaw. If you say you can't hear any difference, that merely proves that you are cursed with wooden ears. If you suggest some double-blind test, you both know that neither of you has the time or the resources to mount them. So you go your separate ways, each harbouring doubts about the other's credibility.

But why the sudden hang-up about digital records and sampling? It seems to

have been overlooked that we have all been listening to sampled reproduction since we were in short pants. I mean it! To AM radio, for example!

In the very process of amplitude modulation, the analog audio signal, as such, ceases to exist. The closest we can get to it is an imaginary line joining the tips of the carrier waveform. In short the audio has been reduced to "samples" at the carrier frequency.

In the receiver, the samples may be applied to the detector as they are, or they may be processed once or twice into smaller numbers of samples at one or more intermediate frequencies.

Ultimately, they are applied to a detector, where the amplitude modulated train of RF cycles (or samples) is resolved into an approximation of the original audio waveform. At the same time, the RF energy itself is suppressed by a low-pass filter, involving shunt capacitance and series resistance and/or inductance.

In short, AM broadcasting is a sampling system and your AM detector is, in effect, a D/A converter feeding the receiver amplifier.

The FM system does not yield quite so easily to mental pictures but one can still end up with information samples being reconstituted, in the receiver demodulator, into an analog waveform.

In response to this, one could object that, in AM and FM broadcasting, the sampling rate is very much higher than the 50kHz used for digital mastering. What's more, AM radio, at least, is such an unpretentious system that it may not expose the subtle shortcomings of signal sampling.

True; true!

Ideally, in this quiescent state, the half cycles of north and south magnetisation should be of equal intensity. When scanned by a playback head – which would typically bridge a number of halfcycles – the energy would substantially cancel to produce a near zero resultant. In other words, in scanning the track, the playback head would receive a train of half-cycle pulses, which would be integrated by the head and subsequent amplifier (and filtering) into zero audio output.

Now let's introduce an audio signal.

WITH AUDIO PRESENT

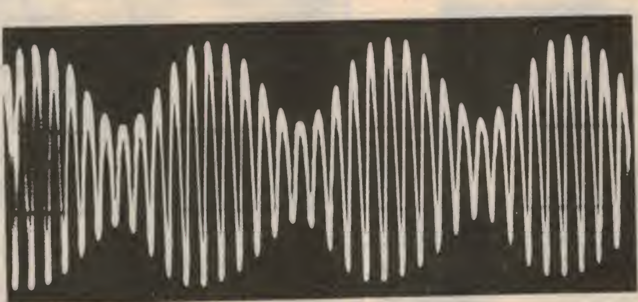
Conceivably, the first audio half-cycle may be of such a polarity that it will, itself, produce a "north" magnetic resultant. In so doing, it will tend to reinforce the "north" half-cycles of bias magnetisation, and diminish the "south" half-cycles of bias magnetisation.

When the first zone is subsequently encountered by a playback head, it will receive a series of strong "north" magnetic pulses interleaved by weaker "south" pulses. The resultant through the amplifier will be an audio envelope having a similar contour at the first audio input half-cycle.

During the next audio half-cycle, the "south" nudges will be stronger than the "north" nudges, and the audio resultant will be of opposite polarity to the preceding half-cycle, as it should be.

Did I say "nudges"?

Yes I did. With AC bias, the playback head is responding to discrete magnetic pulses – not to a smooth and continous analog waveform.



An amplitude modulated carrier, as shown on the screen of an oscilloscope. The tips of the carrier waveform are virtually successive samples of the audio amplitude from which the detector reconstructs an analog audio signal.

But what about analog tape recording? Invariably, this involves the use of a high frequency bias, which is fed to the record head, along with the audio signal. The current through the head at any instant, and the strength and polarity of the magnetic field across the gap, is the resultant of the two inputs.

During periods when there is no audio signal, the polarity of the field across the gap varies in a cyclic fashion in sympathy with the supersonic bias. On a moving tape, the head would lay down a succession of transverse magnetic domains corresponding to successive half cycles of the bias signal. We might describe them as regions across the track, alternatively magnetised north-south-north-south, etc.

Should you prefer one of the traditional "How bias works" diagrams to my prose, you will probably observe that the audio waveform is not present as a separate entity. It exists only as an imaginary line joining the peaks or the median positions of the bias waveform. (Just as in the case of amplitude modulation described above).

In fact, in thoroughly mischevious mood, staff member Paul de Noskowski observed that even the half-cycle nudges of information are made up from still smaller discrete bits: the particles on the tape!

But, this aside, it may be argued that, even if so-called analog tape recording is a sampling system, the bias frequency in quality recorders is normally 120kHz or

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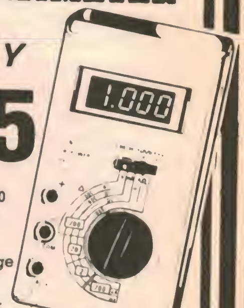

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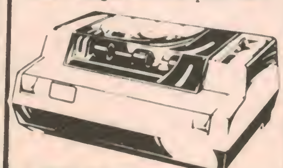

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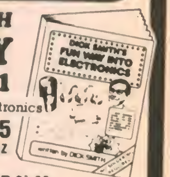

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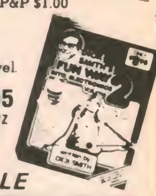

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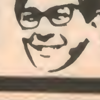


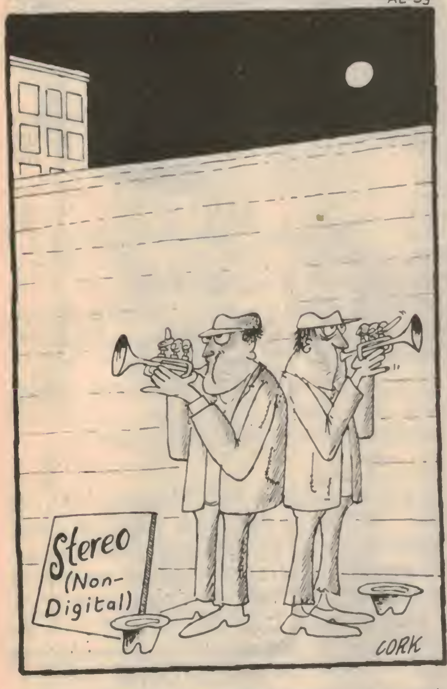
more, giving a high sampling rate, compared with the audio pass band.

True!

Then what about stereo FM, which is regarded as a fairly respectable source of hifi listening?

The left and right channels are reconstituted from a sum signal and a difference signal which is switched to and fro at a mere 38kHz — a substantially lower bit rate than for any of the commercial digital systems. The 19kHz reference tone, the 38kHz switching signal and the switching operation itself all happen right there in the tuner and, from all accounts, the multiplex components are not always suppressed as well as they might be.

AL-39



One wonders why the critics of digitally mastered discs have not, long since, complained about apprehensions and tension produced by stereo FM.

Maybe they would have, if the industry had been more explicit about how it worked!

AWFUL (?) FUTURE

One other point could be made: those who profess to discern stress or other subtle deficiencies in digitally sourced recordings are in for a miserable time during the years ahead.

Pioneered by small companies like Telarc, digital mastering has since been taken up by the larger manufacturers. Now, about half of all the new serious music releases being reviewed monthly by "Gramophone" magazine, are digitally sourced. And that is just the beginning.

All the new video discs, some of them with high quality stereo sound, use digital encoding for the audio tracks. So also will video style multi-channel audio releases, including the Philips designed compact hifi disc, due for commercial release in the next year or so.

What's more, video style discs won't leave the digits behind in the factory, as do the present-day recordings; they will bring them right into the home, for good — or for ill (say the critics).

Even so, the present generation of analog discs and cassettes will not lapse easily, if for no other reason that their sound and their content is adequate for most listeners most of the time. In fact, I tip that they will be strongly supported, first by loyalty and later by nostalgia, to the point where many performances will be re-issued in digital form — just as we are still playing re-recorded '78s.

Nor will the minority criticism of digital techniques be easily abandoned, because it is repeated with religious fervour and may prove extremely difficult either to discredit or support beyond all argument.

Given sufficient time, money and dedication, it is certainly possible to set up "double-blind" tests in which none of the participants know what they are listening too, in the statistical sense. What we can't guard against is participants identifying sound by one means (eg noise floor) and then rejecting or preferring it on other grounds, in line with a preconceived notion.

Maybe, time alone will tell.

TO BE REALISTIC:

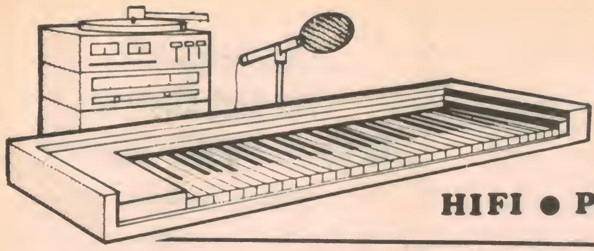
If, in saying all this, I seem to be supporting digital technology, that would be true. But I am certainly not saying that recordings must necessarily be commendable because they are digitally based.

Digital technology can make a measurable contribution to frequency response, noise reduction, dynamic range and reduced distortion. This is all to the good except that, in adverse circumstances, it can more readily expose problems elsewhere and heighten the disappointment at encountering them.

I have often been lavish in my praise of digitally sourced recordings. But, equally, I have expressed disappointment when the result has been compromised by dubious acoustics, or the problems of live concert recording, or a less than exhilarating performance. Recently, I have had to suggest bass boost for one otherwise excellent recording — a most uncharacteristic requirement.

In short, I support the idea of digital mastering for analog discs and tapes, and I am not at all dismayed by the prospect of an all-digital hifi future. Nor am I worried about supersonic phenomena.

But I certainly do not prejudge a recording on the endorsement "Digital", "Direct Cut", "Audiophile", or any thing else. Like the old adage about puddings, the proof of a recording is in the hearing!



VCRs: Their background and their "works"

For what it is, and does, a modern domestic VCR (Video Cassette Recorder) is disarmingly compact and disarmingly simple to use. But there is a lot of confusion about formats and systems and about what goes on behind the knobs and switches. This article won't make you an expert but it may shed some useful light on the subject.

by NEVILLE WILLIAMS

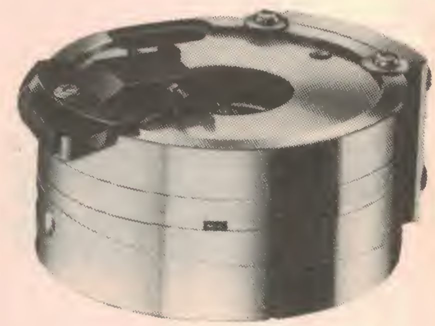


Fig. 1: The video head drum unit from a Sony Beatmax VCR. The centre section carrying the two video heads rotates at 1500rpm. The tip of one head is just visible in the tiny rectangular aperture in its lower edge. As the tape moves slowly around the spinning drum from upper left to lower right, the heads lay magnetic tracks obliquely across it.

Audio enthusiasts will be aware of the enormous amount of research and development that has been necessary to secure top quality audio reproduction from magnetic tape – particularly in relation to compact cassettes operating at 4.8cm/sec.

Consider, then, the problem of recording a complete television signal, which combines an audio sound track with a highly complicated colour video signal having frequency components to about 5MHz – a frequency ratio of about 350:1, relative to audible sound.

The earliest attempts to record video information on magnetic tape – circa 1950 – assumed that the traverse speed of the tape past the heads would have to be very high, and some developmental video recorders were produced on this basis. But the size of the reels involved, and the relative frailty of the tape, could hardly convince engineers that this was the way to go.

Ampex gained the breakthrough in 1956 with their quadrature system, which was subsequently developed by Ampex, RCA and others to become a world standard for the television industry. Ampex fitted four separate heads to a rapidly revolving drum, so arranged that they laid a succession of tracks across a 50mm wide tape which was, itself, moving at a relatively modest speed.

The Ampex approach proved so practical and so capable of progressive refinement that almost all video recorders since then have relied on spinning heads and traverse scanning to achieve the requisite head/tape velocity.

During the '60s, quite a few other video tape recorders were developed using this general approach, but deliberately scaled down in size, cost and specifications to meet possible educational and industrial applications. Most settled for tape narrower than 50mm, drawn obliquely around a spinning drum which carried two record/play heads. It was described as the "helical scan" principle and resulted in tracks being laid across the tape at an oblique angle.

Most of these recorders lapsed for lack of a common standard. However, during the '70s, major Japanese manufacturers agreed on a format using 19mm tape in a special cassette and a system of helical scanning with specific parameters. It became known as the "U-Matic" standard and is still in wide use today in educational and commercial applications, and in a back-up role by the television industry.

The next major step came in the '70s, when various manufacturers addressed themselves to the idea of producing something like the U-Matic format but scaled down still further for use in the home.

Despite the lessons of the '60s, there was a rash of different designs but, in the shake-out which followed, attention narrowed to three – one by Philips in Europe, the "Beta" format backed mainly by Sony, and the "VHS" (Video Home System) backed mainly by JVC and Matsushita.

At the outset, all three groups encountered a real marketing problem in the way of limited playing time. An hour per spool (or cassette) was convenient for professional situations, because of the nature of most events or episodes, and the availability of multiple decks to cover longer programs. But home recordists clearly wanted decks that would record, without interruption, for a much

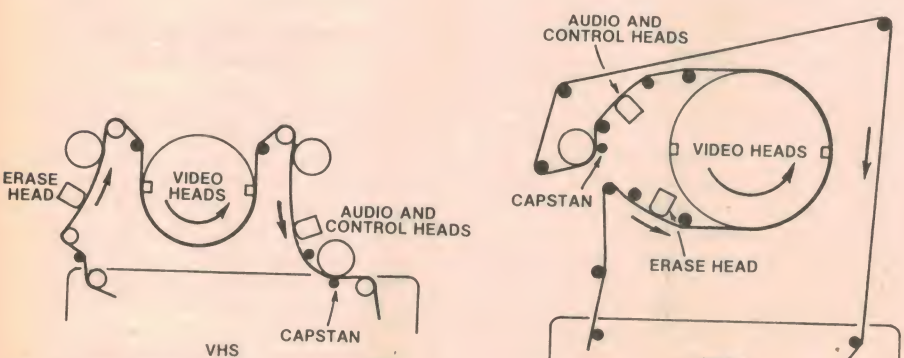


Fig. 2: The VHS format (left) uses what is described as "M" loading, based on the shape of the tape path. It could as easily be described as "U" loading but, by usage, this latter term is associated with the Beta system (right). Note that, in both systems, the video head drum surface is moving much faster than the tape so that the video heads sweep obliquely across the tape.

longer period.

All three groups came up with a two-hour playing time but, at that point, Philips decided to develop a completely new format involving an enlarged version of their highly successful audio cassette, to be known as the Philips VCC or Video Compact Cassette. It would play for four hours on one side, then be flipped over for another four hours on the other side – eight hours total per cassette!

Unfortunately for Philips, the decision put them out of the marketing race at a critical time. However, the new Philips "Video 2000" system is now in volume production in Europe and is reportedly doing very well, with the further backing of companies like Grundig, Pye, B&O, ITT and Siemens. How well it will fare outside of Europe remains to be seen.

In the meantime, the Japanese systems, Beta and VHS, have gained tremendous impetus, world-wide. They have stretched playing times to four hours or more, reduced the cost, size and weight of the decks, while also improving the quality and lowering the cost of cassettes. Versions have been produced for the three major colour systems, NTSC, PAL and SECAM and there are universal decks which will cope in part with all three, where such a need exists.

In addition, a very large array of pre-recorded features has emerged for the two formats, available for either rental or sale. All told, the Beta/VHS duo is now very firmly entrenched and will not easily yield to challenge in the VCR field.

In retrospect, it seems odd that the promoters of Beta and VHS did not sink their differences and agree on a single standard, but the fact is that they didn't. As a result, the world market for VCRs is shared predominantly by two competing formats which do much the same job, offer much the same features and facilities, and cost about the same. But they differ mechanically and electrically to the extent that each can be used only with its own cassettes.

Unlike the traditional audio cassette, the tape in video decks does not remain within the confines of the cassette during record and replay. In both VHS and Beta, a system of fingers and levers opens the front protective cover of the cassette, withdraws the tape and loops it around the various guides, rollers and heads, and the video drum. The operation has to be reversed before the cassette can be withdrawn.

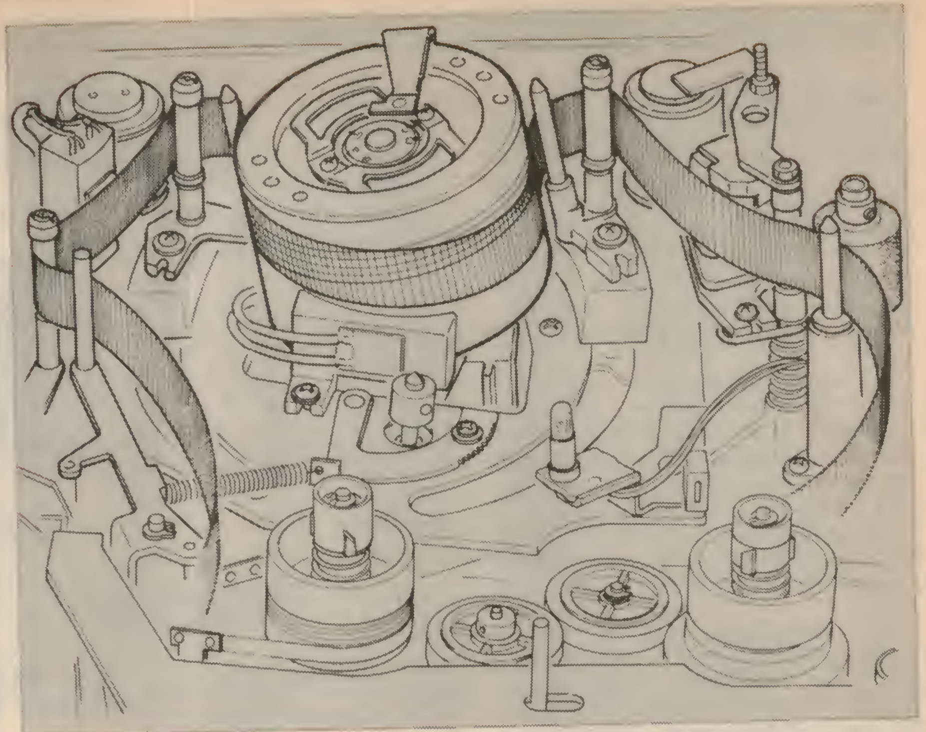


Fig. 4: Reproduced by courtesy of National Panasonic, this diagram indicates the tape path in a typical M-loading VHS format video cassette recorder. In normal record/play mode, the tape moves from left to right. Note the tilt on the video head drum, which puts it at an oblique angle with respect to the tape path. The video heads are in the top half which rotates at 1500rpm for a 525-line PAL system deck. The angle between the helical tracks and the edge of the tape is slightly less than 6°.

TAPE WITHDRAWN

The entire operation is performed by the deck itself, unseen by the user, and obviously calls for a high degree of precision in the mechanism. It also necessitates some interlocking in the mechanism to guard against the user who may impulsively try to withdraw the cassette while the tape is still loaded!

Fig. 2 (not to scale) will serve to illustrate the basic difference between the "M" loading system (VHS) and the "U" loading system (Beta). They represent a somewhat different design philosophy, although it is likely that the line-up of big-name manufacturers behind each has been influenced more by technical and commercial considerations.

It would seem that the M-loading system is the simpler of the two and its protagonists hasten to emphasise this, claiming that there are fewer "contact points" along the tape route and that much less tape is extracted from the cassette – 33cm for VHS compared with 61cm for Beta. This adds up to greater potential reliability, say the VHS supporters, and faster load and unload cycles.

They also stress that the VHS M-loading system unloads the tape back into the cassette before executing "Fast Forward" and "Rewind". This helps to safeguard the tape itself, and isolates the video heads from wear while the tape is merely being cycled in either direction.

While the Beta U-loading system has the appearance of being more complicated, its supporters have historically claimed that the stresses applied to the tape are actually less than with M-loading. Whatever may have been the situation in the past, rival manufacturers say that the reverse is now the case. A recent release from National Panasonic quotes the average tape tension as 27.5 grams for VHS and 45.0 grams for Beta – taken as an average of five current model decks from each system.

Arguments aside, the important thing is that breakage of approved tape does not appear to be a problem with either format.

On the basis of design "philosophy", the Beta system offers one obvious advantage: since the tape is always fully loaded, it is relatively easy to present images in fast or slow motion, forward or reverse, by changing the capstan speed and driving the tape at a greater or lesser speed than for normal replay.

Stop the tape altogether and "still" or "freeze" frame results. All this, without changing the tape path.

Similar facilities can be (and are) provided on VHS decks but with the complication that there has to be a basic change in mode between cue and review, and fast forward and reverse. This arises from the fact that, by definition, the VHS system unloads to tape into the cassette for the last named modes.

A couple of other basic differences are

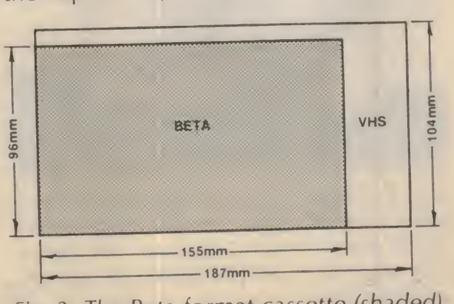


Fig. 3: The Beta format cassette (shaded) is significantly smaller than its VHS counterpart – just one of the reasons why the two are not interchangeable.

worthy of mention here:

The video head drum in a Beta format deck has a larger diameter (7.45cm) than a VHS drum (6.20cm). Since both operate at a speed of 25 revolutions per second (1500rpm), the track laid down by the Beta heads is more oblique (longer) and the writing speed is higher: 5.83m/sec compared with 4.85m/sec. (This for PAL standard decks in both cases.)

The higher speed should make for an improved video frequency response, although VHS interests tend to discount this by claiming that the ultimate response is affected by many other factors, including track width. Rightly or wrongly, manufacturers of both systems tend to claim about the same order of resolution: a modest 260 lines for PAL colour.

This is consistent with the rule of thumb which suggests that, with present-day tape technology, both systems would really need to double their scanning speed to about 10m/sec for full bandwidth and resolution.

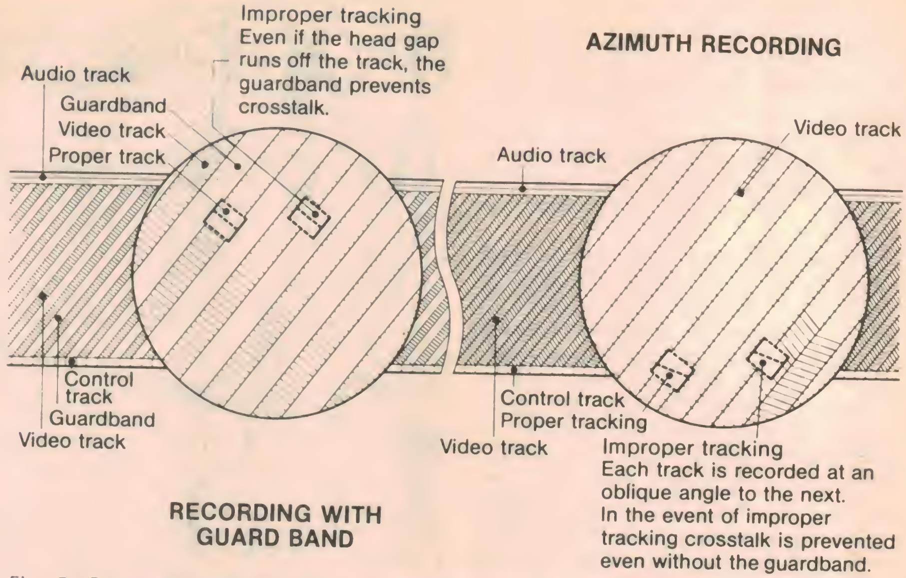


Fig. 5: Prepared originally by Sony, this diagram shows the difference between conventional recording with guard band (left) and azimuth recording, as used in modern domestic VCRs.

CASSETTE SIZE

One other noticeable difference is the size of the actual cassette. Both are loaded with 12.5mm wide tape but the Beta cassette at 155mm x 96mm is markedly smaller than VHS at 187mm x 104mm.

This could offer a potential advantage for Beta in compact VCRs, although any such advantage might be offset by the larger head drum and more convolute tape path.

Where the VHS cassette does score is in its ability to hold a greater length of tape of a given thickness, which can add up to extra playing time. Thus, at the standard playing speed, most common in Australia, VHS manufacturers are happy to endorse and sell a 4-hour cassette. For Beta II decks, operating at a comparable tape speed and loaded with tape of the same 16-micron thickness, the playing time is limited to 3¼ hours.

From the comparative diagrams, it will be apparent that the tape in both cases runs from left to right, during normal record/play, with the magnetic coating on the outer surface and in contact with the heads. By way of example, the tape path through a VHS deck can be followed with the aid of Figs. 2 & 4.

From the left-hand spool in the cassette, the tape first passes over a full-width erase head which, in "Record" mode, erases all signals from the tape, leaving it virtually blank.

Next, the tape passes around the highly polished video head drum assembly, of which the top half, carrying the video heads, is rotating at 1500rpm in a 625-line PAL system deck. The mechanism is so arranged that the spinning heads do not encounter the edge of the tape, but begin each track fractionally inside the upper edge. This minimises impact wear and also reserves the outer edge of tape for two other functions.

Note that the guides adjacent to the head drum in Fig. 4 are shown as inclined – this to compensate for the oblique angle which the video head drum makes with the vertical and horizontal alignment of the remainder of the mechanism.

From the video head drum, the tape passes over guides and rollers to a fixed head assembly containing (usually) three separate head gaps. The first gap, adjacent to the very top of the tape, serves an erase function when the deck is in Record mode, and erases a strip slightly more than 1mm wide along the top edge of the tape.

Fig. 6: Repeated from last month, this picture shows the business end of the video head magnified about 7.5 times. The pole tips and windings are at the extreme bottom of the picture and, in reality, measure about 3mm × 0.8mm. In fact, one of the pole tips – about half the size of a pin head – has been broken off.

In so doing it ensures a blank strip of tape on which a record/play head gap immediately following can impose a 1mm-wide sound track.

A third head gap, aligned with the lower edge of the tape, imposes a 0.75mm track carrying a control signal at the frame frequency of 25Hz. This signal is used, on playback, to ensure that the spinning heads and the tape retain the same relationship that they had when the recording was made.

AUDIO TRACK

It is interesting to note that the 1mm audio track is somewhat wider than one track of a stereo pair on a compact audio cassette (0.6mm) but the actual traverse speed is less than one-half: 23.39mm/sec for VHS and 18.73mm/sec for Beta. Nevertheless, on good quality tape, the tracks can cope reasonably well with ordinary TV sound, as heard on a TV receiver.

Getting back to the video side of things, each single track lying obliquely across the tape, contains one complete scanning field, or the information contained in 312½ lines of a 625-line PAL colour picture. As mentioned earlier, the angle between the tracks and the edge of the tape is about six degrees, being much more oblique and producing much longer tracks than is commonly depicted in illustrative drawings such as Fig. 5.

Even so, it is a tribute to the resolution of the tape and the heads that the signal information contained in over 300 lines across a TV screen can be substantially stored in a single magnetic track slanted

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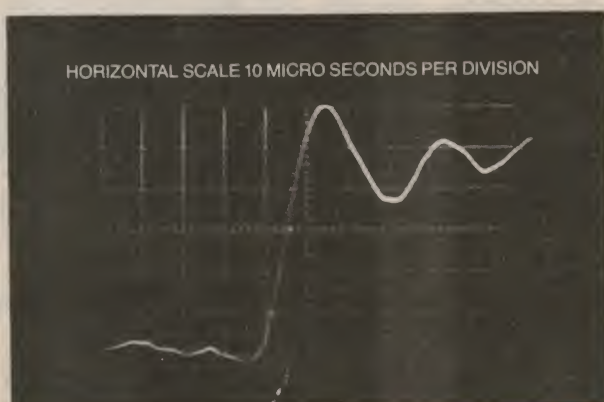

Actual unretouched oscilloscope photograph showing rise time of 980LZS using CBS STR112 record.

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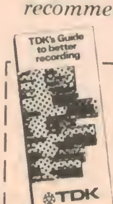

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obliquely across a 12.7mm tape. Each pair of such tracks therefore provides one complete frame: lines 1 to 312½, and lines 312½ to 625.

In the early days of helical scan recording, each track was separated from its neighbour by a guard band – an intervening strip which was free of signal. This was provided so that, even if the video heads wandered slightly from the intended track, no crosstalk would result. (See left-hand portion of Fig. 5.)

In the effort to pack the required data on to a shorter length of tape, "azimuth" recording was developed in the mid '70s. As illustrated on the right hand side of Fig. 5, the guard band is eliminated, so that adjacent tracks lie directly side by side.

To minimise crosstalk if the heads should wander slightly, each head is rotated slightly from the normal 90-degree relationship to the alignment of the track. One is rotated clockwise, the other anti-clockwise. Thus, if one were able to examine the alignment (or azimuth) of the signals on a recorded tape, a difference would be apparent, as illustrated in Fig. 5.

During playback, it is the function of the control track and the associated circuitry to ensure that each track is read by the head having the appropriate azimuth angle. If it happens to overlap the track on either side, the crosstalk is minimised because the magnetised zones lie across rather than along the head gap.

The combination of azimuth recording with ever-narrower tracks and constantly improved electronics and tape, has made it possible to achieve a much higher density of data and progressively longer playing times on a given length of tape.

In the normal PAL decks, most common in Australia, the track width for VHS (up to 4-hour) recorders is 49 microns, and for Beta II (up to 3¼ hour) 33 microns. In the NTSC markets, where there has been a playing-time war, versions of both VHS and Beta decks have been released, operating at reduced tape speed and with video track widths reduced to 19 microns. This extra playing time comes at some cost in picture quality and also in soundtrack quality, because the linear speed of the tape drops to around 12mm/sec, or about one-quarter the speed of the familiar audio cassette!

In Philips' "Video 2000" system, by the way, the video track width is 23 microns and the linear tape speed 24.4mm/sec.

Last month, as you may remember, we talked at some length about the size of the video heads involved and we repeat, as Fig. 6, a magnified photograph of one of the larger (49-micron) heads in current use.

It would be nice to be able to conclude the story at this point, with the implication that these diminutive heads, plus the associated electronics, simply record the incoming video signal on the tape and recover it during replay – or enough of it to ensure a satisfactory TV image.

But it is not as simple as that and here we draw upon a handbook issued by National Panasonic, which explains the further complications. It relates, of course, to VHS but a parallel situation would apply to the Beta format.

It is pointed out, in the National publication, that the video signal contains information from DC to about 5MHz, which can be equated roughly to eighteen octaves. No VCR heads, they say, can cope with a frequency range as wide as this, even if backed up by any practical amount of equalisation.

A further problem is that azimuth recording, as a protection against crosstalk, is valid only for the higher frequencies. At lower frequencies, where the wavelength is long relative to the

SHARP VZ-3000

The size of the system can be judged from the phono turntable.

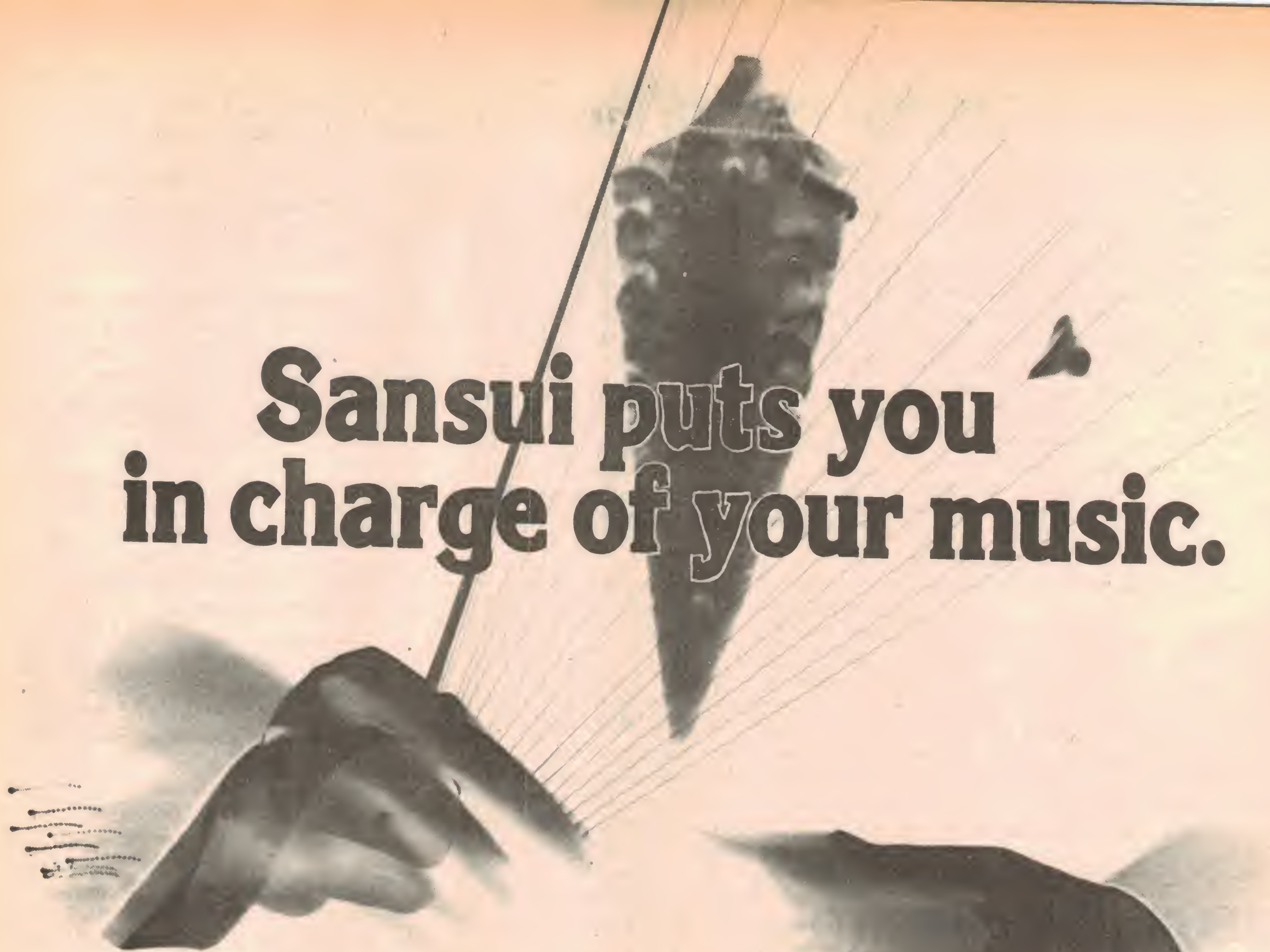
For the home owner or the flat-dweller who wants to pack a lot of modern music making into a small space, Sharp have developed and released their new VZ-3000 home stereo system.

The eye-catching centre-piece of the system is an upright record player which is almost entirely automated.

Press a button and the front face opens downward, allowing the user to pop the record loosely into the lid. Press another button and the lid closes, locking the disc onto the spindle. The player senses its diameter and sets the speed to 45 or 33rpm, as appropriate. If the disc needs to be played at the alternative speed (eg 45rpm for 30cm dia) an over-ride button is available.

What is novel about the player is that it is fitted with two separate linear tracking arms and two cartridges, allowing both sides of the disc to be played, without need to turn it over. The user never touches the actual playing mechanism. Selection of tracks in random order from either side, cueing, repeat tracks, repeat playing, etc, are all accomplished by soft-touch buttons on the front face, under micrologic control.

Associated with the revolutionary record playing deck is an AM/FM stereo tuner, a cassette deck with Dolby NR and Automatic Program Search, a 25W per channel amplifier and multi-channel speakers. The whole system is compact enough to be shelf-mounted. [Details from Sharp Corp of Aust Pty Ltd, 64-72 Seville St, Fairfield NSW 2165. Phone (02) 728 9111].



Sansui puts you in charge of your music.

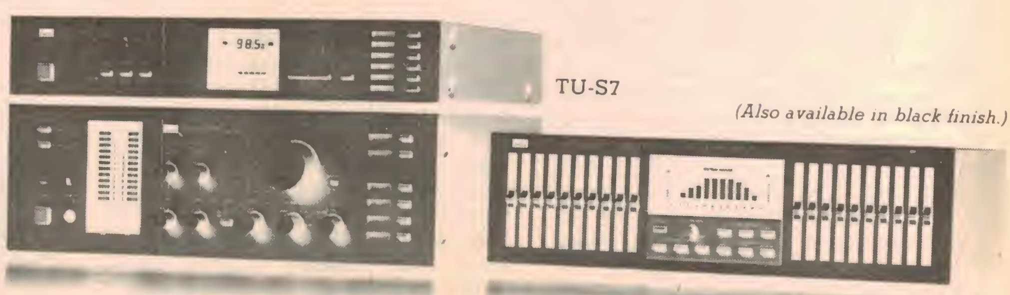
Does listening to your stereo system make you feel like you're at a live performance? Of course it doesn't. And if you don't agree, either you've got a tin ear or you've never been to a live performance. The best a stereo system can hope for is to approach the rich dynamism of the real thing. And at Sansui, that's our goal.

One way we do this is to put you in charge of the way your system sounds. Nobody we know of has a listening room with the fine acoustics of a music hall. And none of the standard reproduction methods—discs, tapes, FM—can accommodate the full dynamic range of a symphony. That's why you need versatile take-charge stereo equipment like the SE-8, a full 10-band stereo graphic equalizer with a built-in real-time spectrum analyzer. In a nutshell, it lets you recreate an approximation of the original performance.

Even if you don't opt for the remarkable versatility of the SE-8, you get *four* tone controls—Superbass, Bass, Presence and Treble—with the AU-D7 "Linear-A" DD/DC integrated amplifier. Plus, you get MC-cartridge capability and the pure-sounding Linear-A design that has eliminated switching and crossover distortion completely.

And when you're ready for the vast treasure-trove of musical enjoyment available over the airwaves, we've got the matching TU-S7 Quartz Synthesizer Tuner. It offers 3 tuning modes including preset pushbutton tuning of 6 FM and 6 AM stations.

If you want your music to sound like a live performance, let Sansui put you in charge.



(Also available in black finish.)

Sansui

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VANFI (AUST.) PTY. LTD. 297 City Road, South Melbourne, Victoria 3205, Australia Tel: 690-6200
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gap and azimuth geometry, protection against crosstalk is lost.

To overcome these problems, the luminance (brightness) information is processed into the form of a frequency modulated carrier deviating between 3.8MHz (sync tips and ultra-black) to 4.8MHz (peak white). In this form, the system can cope with the luminance information reasonably well.

The chrominance (colour) information could pose a special problem, because it is encoded on to a 4.43MHz sub-carrier, superimposed on the luminance information. In the VHS system, the chrominance information on 4.43MHz is isolated and then down-shifted to 627kHz, to be recorded on the tape in that form.

However, at this comparatively low frequency, the azimuth recording provides very little isolation between adjacent tracks. The VHS system overcomes this problem by using a delay line to rotate the phase of the chrominance vectors for each alternate line by 90 degrees. If crosstalk occurs during playback, the crosstalk component complements the prime signal, leaving the chrominance virtually unaffected.

Behind this is the fact that the chrominance information in a colour television image is of much lower definition that the luminance signal. Picture quality is therefore not significantly degraded by some blending of chrominance information between adjacent lines.

On playback, circuitry in the VCR has to reconstruct a standard variable amplitude video signal from the FM signal off tape, up-convert the chrominance signal to 4.43MHz and impose it again on the luminance information. It then has to modulate it onto an RF carrier to feed into the antenna terminal of a TV receiver, and provide a second carrier frequency modulated with the sound.

What's more, a modern VCR does all this without user adjustments. Automatic internal circuitry tailors the incoming video and audio signals to the needs of the recorder and the tape. On playback, and after all the processing, the signals re-emerge at a predetermined and convenient level for a domestic TV receiver.

That VCRs work at all is gratifying; that they work so well is surprising; that they can be bought for less than $1000 is amazing!

In brief . . .

GARRARD, the once renowned manufacturer of phono turntables, all but disappeared from the market, due to competition from Japan. However, it was taken over by the Brazilian electronics company Gradiente, which plans to release a new range of Garrard turntables, manufactured in Brazil, except for the actual platter. The Swindon (UK) factory has discontinued its earlier models and will begin assembling the new range.

Sony audio-video festival

In a lavishly staged and well-supported audio-video "Festival" in Sydney's Centrepoint building, Sony (Australia) Pty Ltd displayed to the media and the public the kind of products which can be theirs for the '80s. They ranged from tiny personal stereo music players, through consumer and professional video, to satellite television.

Occupying three levels of the Conference centre, the Festival was officially opened by Mr Kazuo Iwama, President of the Sony Corporation, and Mrs Iwama. They were introduced to the audience by Mr Matsuzaki, Managing Director of Sony (Australia) Pty Ltd.

Kazuo Iwama, President and Chief Executive, Sony Corporation, Tokyo, Japan.

Featured in the display were two projection TV systems, one of them in "Cinemascope" format, similar to what is being considered for use in 747 airliners. The other, involving a "coffee table" projector unit, was set up in a simulated domestic loung/viewing room.

With their SL-C7EC VCR already very popular at the upper end of the Beta market, Sony have now released this "no frills" SL-C5. It has a timer and camera input socket.

Also prominent were Sony "Profeel" TV monitors, with screens to about 75cm diagonal. As used in the home, they would normally be interconnected with a TV tuner, VCR or video disc source, and a hifi system to handle the (hopefully) stereo sound.

Billed as the "World's smallest hifi", Sony's WM-2 "Walkman" attracted a lot of attention.

Combining entertainment with a glimpse of the future, the auditorium had been set up with seating, stage, and orchestra, for artists like Julie Anthony and Barry Crocker. The show was picked up by a Sony TV camera and bounced from a simulated satellite in the ceiling to a typical microwave dish, before being down-converted and fed to a normal domestic receiver.

Other video equipment included an array of domestic and sub-professional colour cameras, with sets and models to simulate real situations. An industrial video mixing desk, operating in conjunction with the cameras, showed some of the facilities which are available at this level of technology.

VCRs were everywhere in evidence — Betamax, of course! The full-facility SL-C7EC is now being joined by a new "no-frills" model SL-C5, as pictured. It offers partial remote control but misses out on channels 3 to 5A and can be used only with a receiver fitted for UHF reception.

By contrast to the video displays, a line-up of "Walkman" miniature personalised stereo cassette players was attracting solid attention. It is a market that Sony created with their first "Walkman" a couple of years back.

Add amplifiers, tuners, and a new communications style portable AM/FM radio, and the public certainly got their money's worth from a free exhibition!

HIFI REVIEW

AKG phono cartridges

Just released by AWA is a new range of magnetic phono cartridges from AKG, the well-known Austrian manufacturer of microphones, headphones and other transducers. We evaluated three of these cartridges and found that they gave a good all-round performance.

This new family of cartridges supersedes the range of AKG cartridges which we reviewed some four years ago in April 1977. Designated P10ED, P15MD, and P25MD they all have the same body shape and the stylus assemblies are interchangeable. Thus, it may be possible to upgrade the performance of the lower-priced models by substituting the assembly from a dearer version. However, specifications can only be guaranteed when a cartridge body is used with its designated stylus assembly. And we noted that the top-of-the-line cartridge body has different inductance and impedance specifications to those of the others.

As with the majority of magnetic cartridges on the market today, AKG use the "induced magnet" principle. They have 12.7mm mounting centres, standard colour-coded output terminals and an output signal suitable for contemporary phono preamplifier inputs.

The measured 1kHz output level was 1.5mV/cm/sec for the P10ED, 0.88mV/cm/sec for the P15MD and 0.77mV/cm/sec for the P25MD.

Recommended load for each cartridge is 47kΩ shunted with 470pF. As many installations will have total input capacitances less than this, shunt capacitors should be added to obtain the optimum capacitance.

Quoted winding inductance is 200mH for the P10ED and P15MD, and 170mH for the P25MD. This conforms with the trend that newly designed cartridges have less inductance than those of previous generations.

Provided that the trade-off of output signal level for reduced inductance is not carried to extremes, we thoroughly agree with this trend. As mentioned in previous reviews, lower inductance means that cartridges will be more tolerant to high-loading capacitance — as often inadvertently occurs — and lower than normal resistive loading.

Like most cartridges the AKG ones have precision-moulded bodies, coupled with a mass of only 3.5 grams — the lowest we have yet encountered. Whilst this is an advantage — when used in a suitable arm — as it reduces the "dumb bell" inertia effect, it could pose a problem with some arms which have insufficient range of counterbalance adjustment. However AKG include a 2 gram "ballast" weight in the mounting kit to solve the problem. Also included are mounting screws and small screwdriver.

Unlike previous AKG cartridges, this new range is supplied with removable clip-on stylus guards. Whilst this slightly reduces the cartridge mass, we prefer the flip-down stylus guard as they cannot be lost and their location encourages their use. In addition the shape of the AKG clip-on guards is such that they are difficult and "fiddly" to remove, sometimes resulting in them coming away complete with stylus assembly!

The three AKG cartridges with clip-on stylus guards removed. Note how the base area has been relieved to facilitate positioning of the mounting nuts.

Each cartridge has its serial number stamped onto the body, and both the P25MD and P15MD are supplied with individual frequency response and interchannel separation curves — appropriately identified with the serial number. Curves are not supplied with the bottom-of-the-range P10ED.

We tested the top-of-the-line P25MD at the recommended stylus tracking force of 1.0 gram, and found that it successfully tracked the +12dB drum test track on W & G 25/2434 but slightly mistracked on the +16dB track. Frequency response was within ±2.5dB from 20Hz to 18kHz, and only 3dB down at 20kHz. In common with other moving magnet cartridges, it exhibited a characteristic 1dB droop in response between about 3 and 7kHz. Interchannel separation was better than −28dB at 1kHz, −18dB at 10kHz, and −15dB at 18kHz.

The P15MD was tested at its recommended stylus tracking force of 1.25 gram. It also tracked the +12dB drum test track on W & G 25/2434, with only very slight mistracking on the +16dB track. Frequency response was within ±2dB from 20Hz to 18kHz, and 3dB down at 20kHz. Strangely it did not exhibit the expected droop in response in the mid-high frequency region. Interchannel separation measured better than 24dB at 1kHz, 15dB at 10kHz and 10dB at 18kHz.

Square wave response at 1kHz was reasonably good on the P25MD, but very fair only on the P15MD — which exhibited approx 20% overshoot followed by a largish train of damped oscillations. The P10ED behaved similarly, except that its overshoot was of the order of 25 to 30%. Not good.

In common with the majority of induced and moving magnet cartridges, the waveform deteriorated in the high frequency region, with the normal sinoidal shape noticeably "skewing" at frequencies of 3kHz and above. This is a lower frequency than occurs with many other cartridges; yet unlike most others, the skewing disappeared at frequencies above 8kHz. Whilst all three cartridges were very similar in their waveform deterioration, the middle-of-the-road P15MD was least affected.

AKG PHONO CARTRIDGES

Whilst the bottom-of-the-range P10ED has a recommened stylus tracking force of 1.5 grams (50% greater than the P25MD), this is still low compared with many other budget-priced cartridges; and it also successfully tracked the +12dB drum test track on W & G 25/2434, with only slight mistracking on the +16dB track. Frequency response was within ±2dB from 20Hz to 18kHz, and 4dB down at 20kHz. Like the P15ED it also showed no droop in response in the mid-high frequency region. Interchannel separation was better than 24dB at 1kHz, 20dB at 10kHz and 16dB at 18kHz.

All versions are fitted with elliptical styli and produced the above frequency response and separation figures when playing the CBS STR100 test record. On recorded music, the sound quality is clean and pleasant, with the P25MD discernibly better balanced than the less expensive versions. Both the P10ED and P15MD were, perhaps, a trifle overbright – although this is a characteristic often liked by many hifi enthusiasts. And for the buyer on a budget, the P10ED would be the one to go for.

Housed in soft plastic cases, the AKG cartridges are each supplied with stylus cleaning brush, small screwdriver and mounting hardware.

In short, these AKG cartridges can be considered as providing reasonable value for money in a competitive market.

Recommended retail prices for the cartridges are $59 for the P10ED, $79 for the P15MD, and $179 for the top-of-the-line P25MD. Further details can be obtained from high fidelity retailers or the Australian distributors – Amalgamated Wireless (Australasia) Ltd, 554 Parramatta Rd, Ashfield, NSW, 2131. (P. de N.)

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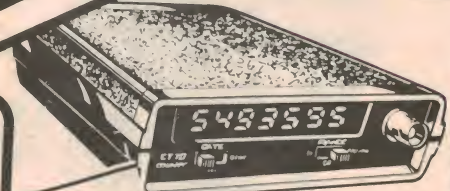

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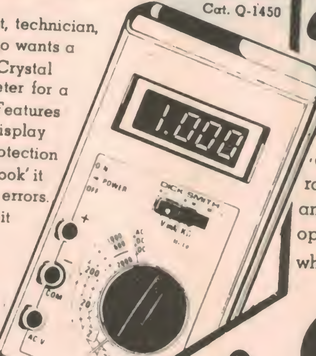

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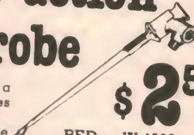

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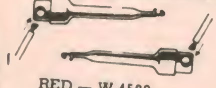

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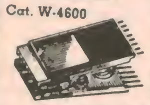

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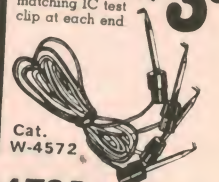

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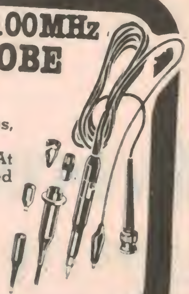

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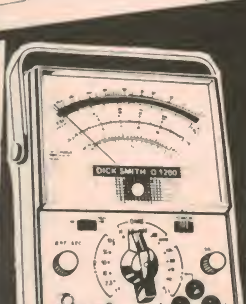

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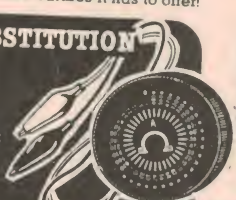

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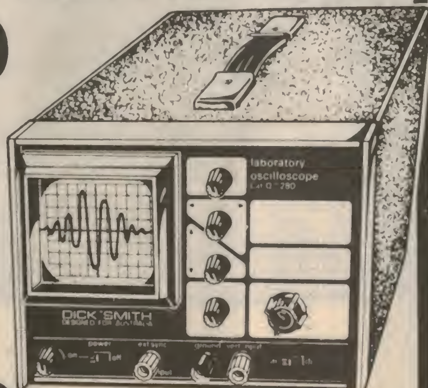

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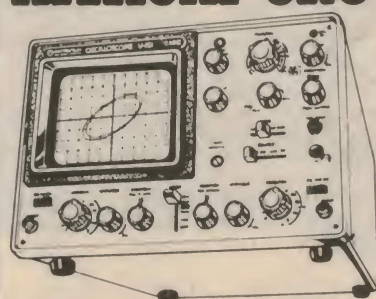

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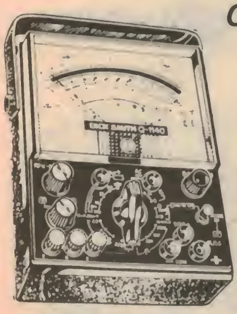

This handy little unit is virtually a test bench in one small package! Not just a sensitive (100k/V) multimeter. This one checks transistors and measures capacitance etc. Fuse and diode protection of the movement. If you want a multimeter that will do just about anything. — look no further! Complete with battery, test leads, and full instructions.

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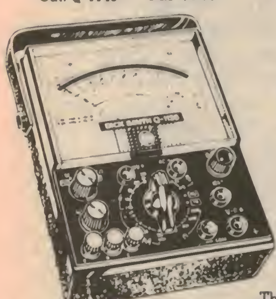
Q-1136 transistor checker multi-meter



Cat. Q-1136 P&P $4.00

This unit is similar to the one above except for a few minor differences. i.e. does not have capacitance checking facilities, nor does it have a 250mV DC position. But the really good news is that it's CHEAPER!! Everything else is much the same, so it is up to you — the money or the best!

$57.50

UNBELIEVABLE VALUE!!!

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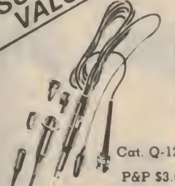

This incredibly versatile probe set is so good we thought we'd mention it twice Ideal for any CRO and comes with an abundance of accessories!

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Plugs into the Dick Smith CRO enabling accessones from more expensive sets to be used

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Extend the useful range of your multimeter with this neat probe

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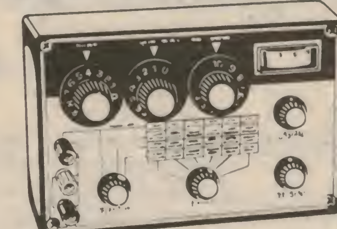

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Our best Musicolour yet . . .

MUSICOLOUR IV

4-channel colour organ plus light chaser

Add excitement to your parties, prawn nights and discos with our new Musicolour IV light show. This is the latest in our famous line of Musicolours and it offers many features such as four-channel "colour organ" plus four-channel light chaser, front panel LED display, internal microphone, single sensitivity control plus opto-coupled switching for increased safety.

by RON DE JONG

Since we published our first Musicolour back in October 1969 most people have probably seen at least one in a disco or at a party – and been impressed. It really adds life to the party with its kaleidoscopic light show beating to the sound of the music. Its continuing popularity is the reason why we have produced updated versions, the last being the Musicolour III in September 1976.

Our latest version is the Musicolour IV and it offers quite a few advantages over previous units. The most obvious change is that the Musicolour IV is a four-channel light unit rather than a three-channel unit; that is it divides the music input into four frequency bands and modulates the lights in each channel according to the amplitude in each band. Typically, four differently coloured flood lights would be connected, one to each channel – red for the lowest band, then yellow, green and blue.

Some basic improvements which have been made in the Musicolour IV are that the separation between frequency bands has been considerably sharpened and the response of the lights is more linear. Also, because of the wide range of the sound-to-light response, individual channel sensitivity controls are not required – just one master sensitivity control. This makes it easy to set up since little adjustment is required to get a good display.

With the flick of a switch the unit also operates as a four-channel light chaser which features forward/reverse plus an automatic forward/reverse which can be adjusted to reverse the direction of the chaser from every ½ second to about 10 seconds. Four chaser patterns can be selected via the PATTERN control and these include single lights chasing, "holes" chasing and two lights chasing – in fact every possible combination. The rate at which the lights chase is set by the SPEED control or the lights can be made to chase in time with the music by switching the MUSIC/OSC switch to MUSIC.

When operating as a light chaser the unit also features zero-voltage switching, ie, the Triacs are switched on only at the beginning of a mains half cycle. This largely eliminates radio interference and reduces the inrush currents to the lights.

Two more features we have included are an internal electret microphone and a LED display on the front panel. The electret can be used in place of the normal input from the speaker output of the amplifier by switching the MICROPHONE/SPEAKER switch. This is a useful in circumstances where it is inconvenient to bring a speaker connection to the Musicolour.

The front panel display consists of four LEDs, one for each channel, and when a particular channel is turned on the corresponding front panel LED will also turn on. This is a useful diagnostic aid and it also clearly shows the operation of the light chaser, eg the pattern selected and forward/reverse. The circuit has also been designed so that the LEDs will be modulated in the Musicolour mode.

Perhaps the most important feature, from a safety point of view, is that we have used opto-coupled Triac drivers. These are relatively new devices similar to opto-couplers, except that instead of

having an internal LED optically coupled to a phototransistor, it is coupled to a photosensistive silicon bilateral switch which will directly trigger a normal Triac via a single resistor. This allow us to have all of the Musicolour circuits operate at low potential, except for the Triacs themselves.

CIRCUIT DESCRIPTION

To see how the Musicolour section of the unit works first refer to Fig. 1 which shows a block diagram of the unit. First off there is a switch which selects microphone preamp or the speaker outputs of a stereo amplifier. The signal is amplified and then fed to four bandpass filters which are tuned to the following bandpass frequencies: 0-200Hz, 200Hz-700Hz, 700Hz-2kHz and 2kHz and up. These frequencies were designed to give a reasonable division of the musical spectrum – note that the top filter would seem to have more than its fair share but in fact there are very few musical notes above 4kHz (just harmonics).

Outputs of the filters are rectified and filtered to produce a DC voltage corresponding to the signal amplitude in the four frequency bands. This voltage is then used to control a Triac circuit so that the light output is proportional to the sound amplitude. To understand how this is accomplished we have to examine the operation of a Triac.

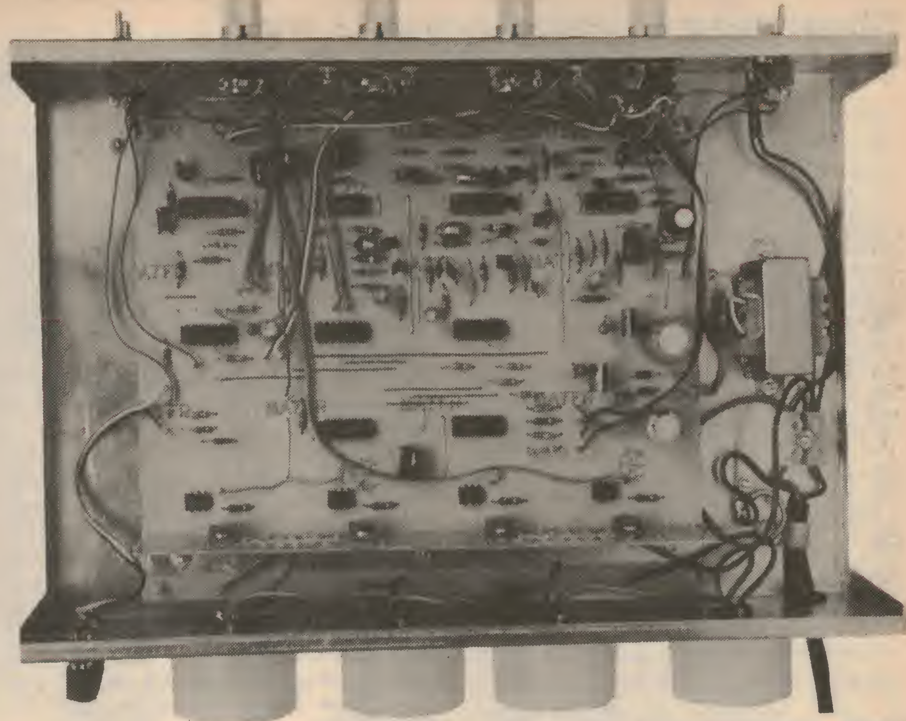
The Triac is a bidirectional switching element, ie it is either fully on or off. Since it is bidirectional it has no anode or cathode as such, but has two main terminals called A1 or A2 plus a control terminal called a gate. When a brief trigger pulse is applied between gate and terminal A1 the Triac turns full on and remains on until the load current drops to zero, ie, at the end of each mains half cycle.

PHASE CONTROL

We can thus control the amount of power delivered to a light and hence its brightness by "firing" the Triac at a set time or "firing angle" after the start of each mains half-cycle. This is referred to as phase control. For example, if the Triac is fired at the beginning of each half cycle, full power will be delivered whereas if it is fired at the end of a half cycle, no power is delivered.

To vary the "firing angle" and hence light output in proportion to the signal amplitude we have used a ramp circuit. This circuit consists of four comparators which have their inverting inputs connected to a common "ramp" signal and their non-inverting inputs connected to the outputs of the four filter/rectifiers. The ramp signal is reset high at the beginning of each mains half-cycle and falls to some value toward the end of each half-cycle.

The comparator outputs are used to trigger the Triacs. Now if the input to a comparator is relatively high the comparator output will go high sooner within each mains half cycle, firing the Triac and delivering more power. A low input voltage will cause the comparator output to go high later in each cycle thus firing the Triac later (see Fig. 1). To make the brightness of the lights match the apparent sound level the ramp signal is actually quite complex and takes into account the firing angle versus apparent light output and the logarithmic response of our hearing.



View inside the prototype. Use of opto-couplers to drive Triacs means that most of the circuit (but NOT Triacs or heatsink) operate at low potential.

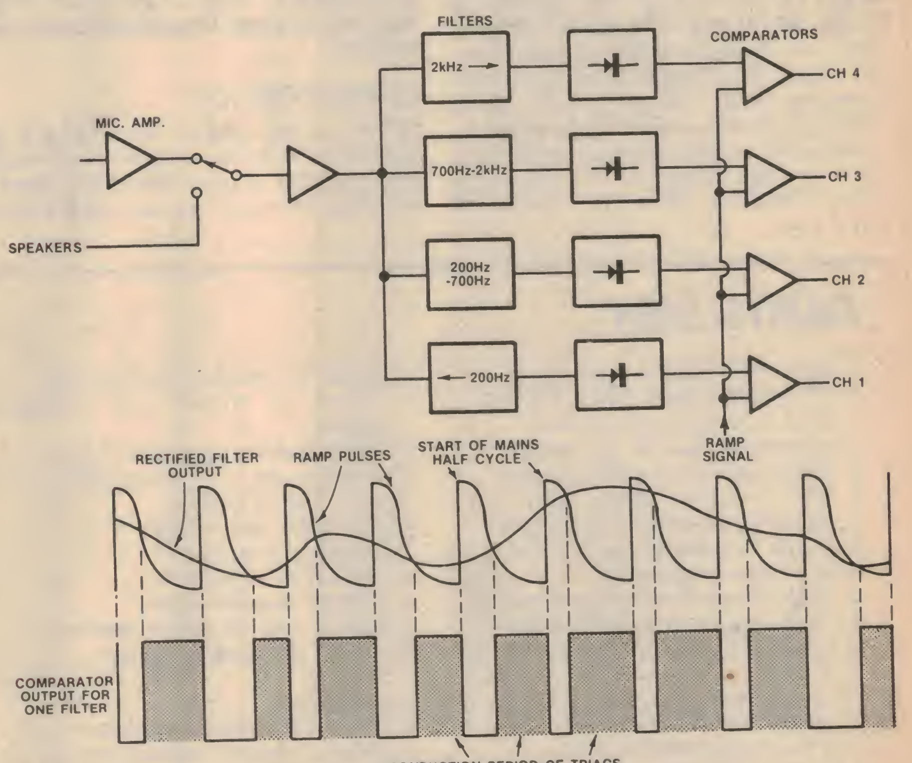


Fig. 1

MICROPHONE PREAMP

Referring now to the circuit diagram, the electret microphone is an "insert" type which has an earth connection and output connection which has to be taken to supply via a 4.7kΩ resistor forming the load for the internal FET preamplifier.

The supply to the electret is decoupled via a 1kΩ resistor and 100μF capacitor to reduce hum and noise. Output from the electret is coupled to IC1a via a .047μF capacitor. IC1a is connected as a non-inverting amplifier with a 150kΩ resistor on the input to set the DC bias and with a gain of almost 50 set by the voltage divider ratio of the 470kΩ and 10kΩ resistors.

Switch S1 selects either the output of the microphone preamplifier or the speaker outputs of the stereo amplifier. The speaker outputs are mixed and attenuated by the two 10kΩ resistors and the 1kΩ resistor. We have also included a 100Ω resistor in series with the earth line to prevent any earth loops or damage to the amplifier if the speaker active lines are inadvertently connected to the input ground.

The selected input is passed to a 100kΩ pot (sensitivity control), then coupled via a 0.1μF capacitor to another non-inverting amplifier IC1d. This amplifier drives the four filters we mentioned earlier where IC1b is the 200Hz low-pass filter, IC2d and IC2c pass 200Hz to 700Hz, IC2a and IC2b pass 700Hz to 2kHz and IC3d is a 2kHz high pass filter. To ensure that there is good separation between bands, each filter rolls off at 18dB per octave outside the passband.

Each filter output drives a simple half-wave rectifier (diodes D1 to D4) and a 4.7μF capacitor filter. A resistor in parallel with each filter capacitor sets the time constant of the filter which is designed to be long enough to reduce ripple but short enough to make the Musicolour display fairly dynamic. For this reason we have used a slightly longer time constant on the 200Hz low-pass filter by using a 22kΩ resistor whereas the other filters have 10kΩ resistors.

Germanium diodes are specified for D1 to D4 to maximise the dynamic range of the circuit.

The filters are followed by four comparators as shown in Fig. 1. The comparators are LM339 single supply quad comparators, ie there are four comparators in one package. The outputs are open-collector with 10kΩ pull-up resistors and are passed to IC8 which is a 4019B CMOS demultiplexer. The demultiplexer has two sets of four inputs; one set comes from the Musicolour circuit, the other from the chaser circuit. When pin 14 is high and pin 9 low the Musicolour inputs are selected and passed to the four outputs of the device. Alternatively when 14 is low and pin 9 high, the chaser inputs are selected.

CHASER CIRCUIT

Heart of the chaser circuit is IC6 a 40194 CMOS universal bidirectional shift register. It has four parallel inputs labelled P0 to P3 which can be loaded into the register, four outputs labelled Q0 to Q3, a shift-left input labelled DSL and a shift-right input labelled DSR plus a clock input and two control inputs called S0 and S1. The control inputs set the mode of operation: if S0 is high and S1 low then shift right; if S0 low and S1 high shift left; and if both are high, load the register from the parallel inputs.

Two of the parallel inputs P0 and P3 are wired with P0 to Vcc and P3 to ground. The two other inputs, P1 and P2, go to a 2-pole 4-position rotary switch, S5, which selects four possible patterns by switching P1 and P2 through the four possible combinations of high and low. It may not be immediately obvious but this simple arrangement offers every possible pattern for a four channel chaser. For example, a single light chasing would correspond to P1 and P2 low, while a hole chasing would be P1 and P2 high.

To load the selected pattern the two control inputs S0 and S1 must be both high as we mentioned earlier. To accomplish this and also control the left/right shift control we have connected both S0 and S1 to the Q and Q-bar outputs of a 4013 CMOS D flipflop IC9a. Normally the Reset and Set inputs of the flipflop, pins 4 and 6, will be pulled low via the 10kΩ resistor and the Q and Q-bar outputs will be the complement of each other. If a high was last clocked into the flipflop Q will be high and Q-bar low making IC6 shift right; alternatively,

PARTS LIST

1 K&W Instrument case, C1284
1 PC board, 81mc8, 211 x 175mm
1 2851 12V mains transformer
1 aluminium heatsink (see text)
4 SPDT miniature toggle switches
1 SPDT centre-off toggle switch
1 momentary-contact pushbutton
1 2-pole 4-position rotary switch
4 large LEDs with bezels
2 1MΩ (linear) rotary potentiometers
1 100kΩ (log) rotary potentiometer
4 surface-mounting 3-pin mains sockets
1 4-way speaker terminal
1 electret microphone insert
1 2-way mains terminal strip
1 mains cable clamp
1 mains cable and plug
6 large rubber grommets
4 6mm plastic board supports
2 solder lugs

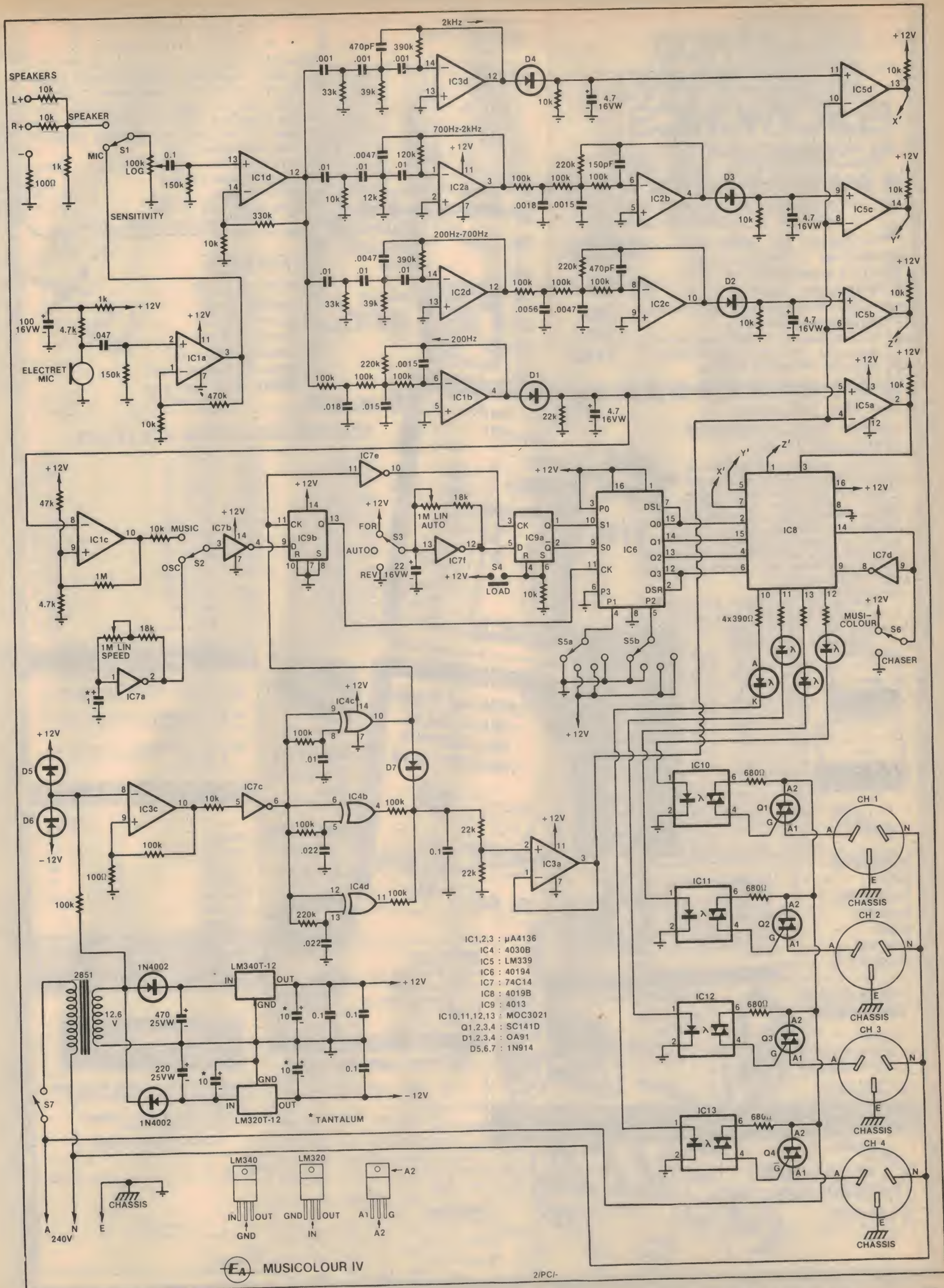
SEMICONDUCTORS
4 MOC3021 optically-coupled Triac drivers
3 μA4136 quad op amps
1 LM339 quad comparator
1 4030B or 4070B quad XOR gate
1 74C14 or 40106B hex Schmitt trigger
1 40194 bidirectional shift register
1 4019B quad 2-to-1 demultiplexer
1 4013 dual D flipflop
4 SC141D 6 amp Triacs
1 LM340T-12 regulator
1 LM320T-12 regulator
2 1N4002 rectifier diodes
3 1N914, 1N4148 silicon diodes
4 OA391 germanium diodes

CAPACITORS
1 470μF/25VW PC electrolytic
1 220μF/25VW PC electrolytic
1 100μF/16VW PC electrolytic
1 22μF/16VW tantalum or low leakage electrolytic
3 10μF/16VW tantalum electrolytic
4 4.7μF/16VW PC electrolytic
1 1μF/16VW tantalum or low leakage electrolytic
5 0.1μF greencap (metallised polyester)
1 .047μF greencap
2 .022μF greencap
1 .018μF greencap
7 .01μF greencap
1 .015μF greencap
1 .0056μF greencap
3 .0047μF greencap
1 .0018μF greencap
2 .0015μF greencap
3 .001μF greencap
2 470pF polystyrene or ceramic
1 150pF polystyrene or ceramic

RESISTORS (all ¼W 5%)
1 x 1MΩ, 1 x 470kΩ, 2 x 390kΩ, 1 x 330kΩ, 4 x 220kΩ, 2 x 150kΩ, 1 x 120kΩ, 15 x 100kΩ, 1 x 47kΩ, 2 x 2 x 33kΩ, 3 x 22kΩ, 2 x 18kΩ, 1 x 12kΩ, 2 x 39kΩ, 15 x 10kΩ, 2 x 4.7kΩ, 2 x 1kΩ, 4 x 680Ω, 4 x 390Ω, 2 x 100Ω.

MISCELLANEOUS
Board pins, 10 9mm screws plus nuts, 8 12mm screws plus nuts, ½ metre rainbow cable, 240V AC rated hook-up wire.

NOTE: The "B" suffix on CMOS part numbers indicates that it is a buffered device. Where buffered devices are specified they must be used.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ELECTRET MIC
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IC1b
IC1c
IC1d
IC2a
IC2b
IC2c
IC2d
IC3a
IC3c
IC3d
IC5a
IC5b
IC5c
IC5d
2kHz
700Hz-2kHz
200Hz-700Hz
200Hz
D1
D2
D3
D4
D5
D6
D7
4.7 16VW
X'
Y'
Z'
+12V
-12V
MUSIC
OSC
S2
IC7a
IC7b
IC7c
IC7d
IC7e
IC7f
1M LIN SPEED
1M LIN AUTO
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AUTO
REV
S3
IC9a
IC9b
S4
LOAD
IC6
IC8
S5a
S5b
MUSI-COLOUR
S6
CHASER
4x390Ω
IC4b
IC4c
IC4d
IC10
IC11
IC12
IC13
680Ω
Q1
Q2
Q3
Q4
CH 1
CH 2
CH 3
CH 4
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220 25VW
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LM340
LM320
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A2
G
IC1,2,3 : µA4136
IC4 : 4030B
IC5 : LM339
IC6 : 40194
IC7 : 74C14
IC8 : 4019B
IC9 : 4013
IC10,11,12,13 : MOC3021
Q1,2,3,4 : SC141D
D1,2,3,4 : OA91
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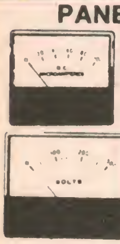
AD2273-T8	$5.03	ADF500-4500-8	$19 44
AD4060-W8	$19 06		

PANEL METERS



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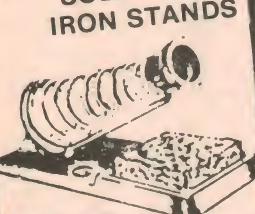

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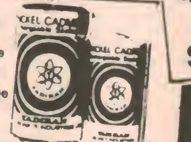

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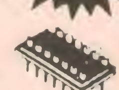

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HS3 — 150mm	5 80	5 40	4 90	3 80	2 90	2.70
HS4 — 225mm	8 10	7 60	7 10	5 90	4 50	4 30
HS5 — 300mm	8 90	8 40	7 90	6 50	4 90	4 60
Unanodised						
HS11 — 38mm	1.40	1 20	1 00	0 90	0 80	0 70
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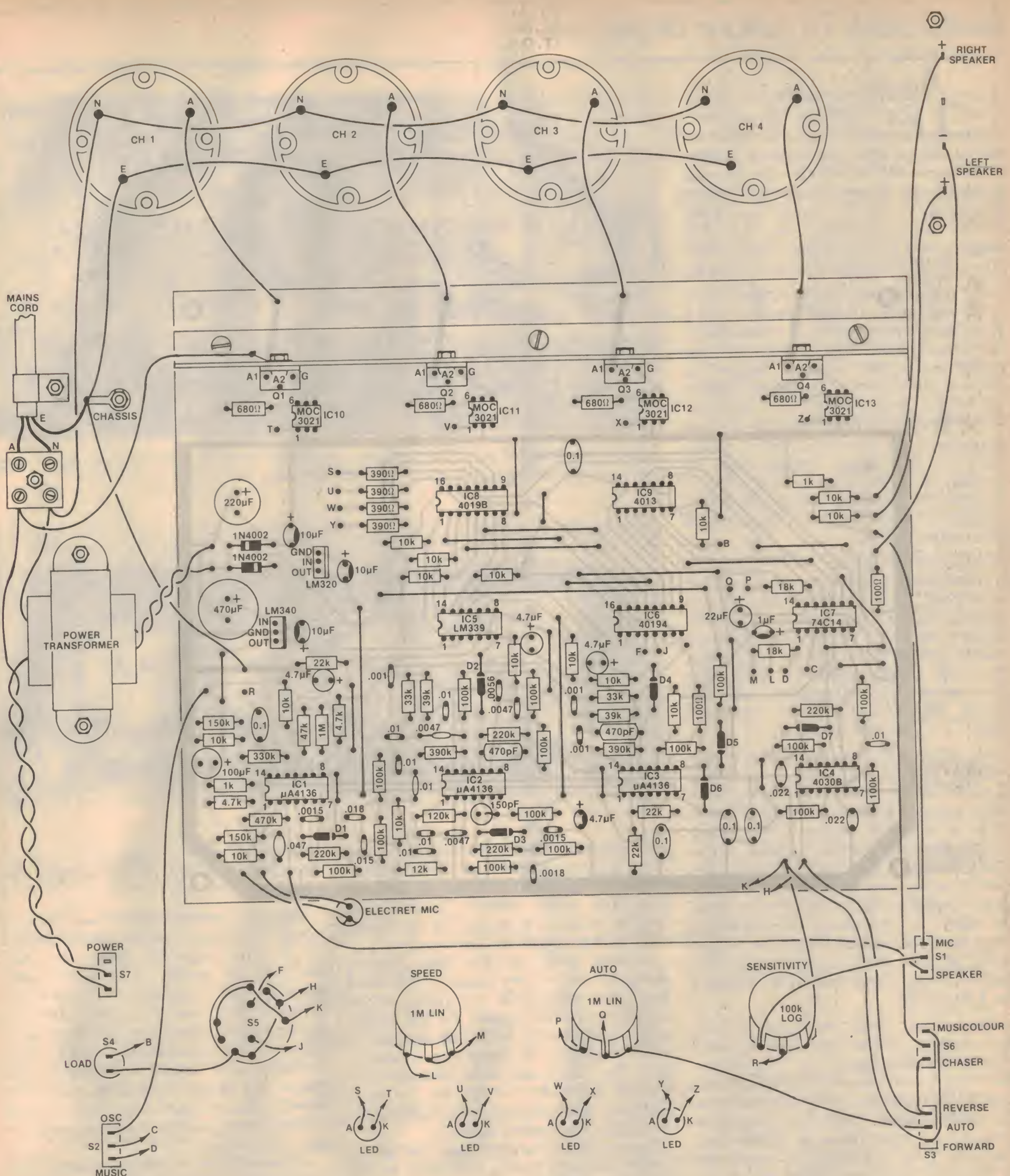


Follow this wiring diagram exactly to make your Musicolour as safe as possible.

if a low was clocked in, Q would be low and Q-bar high, resulting in a shift left.

When both the Reset and Set inputs are pulled high via the front panel LOAD button, S4, both outputs of the flipflop will go high so S0 and S1 go high loading the parallel inputs into the shift register on the next clock pulse. If S4 is held down the selected pattern will be held and can be clearly seen on the front panel LED display or the lights themselves and when it is released the lights will chase.

ZERO-VOLTAGE SWITCHING

The rate at which the lights chase depends on the clock input to the shift register. This could come from a simple oscillator but since we require zero-voltage switching we must somehow ensure that the outputs of the shift register only change at the zero crossing points, eg, if the shift register was clocked right in the middle of a mains half-cycle at least one output will go high turning a Triac on.

This is avoided by taking the clock input from the output of the other D flipflop IC9b. The data (D) input of the flipflop goes to IC7b, a Schmitt trigger us-

ed as an inverter and thence via switch S2 to either an oscillator or a music-triggered pulse generator. The clock input of the flipflop comes from a zero crossing detector which clocks the flipflop's data input to the output at the beginning of each mains half-cycle. Hence the clock input to the shift register, and therefore the register outputs, will only change on a zero crossing.

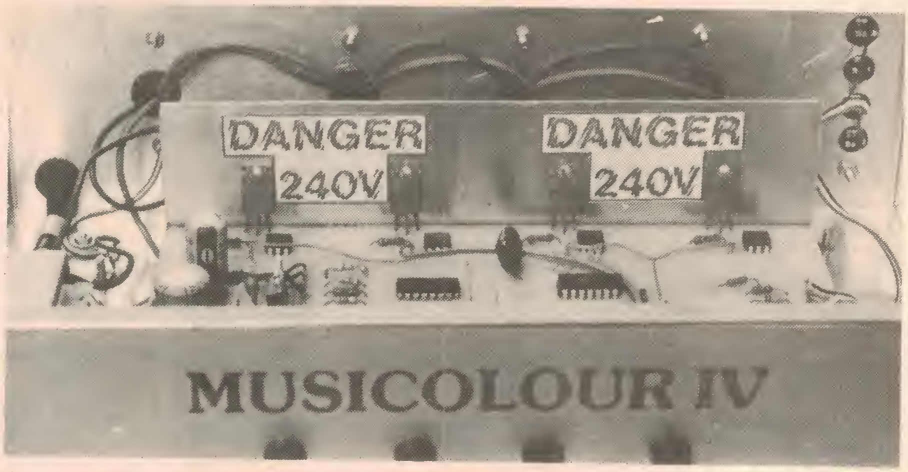
The oscillator uses Schmitt trigger IC7a, a 1μF capacitor, an 18kΩ resistor and a 1MΩ potentiometer. This is a particularly simple oscillator which relies on the hysteresis of the Schmitt trigger, as follows. The Schmitt has two well defined trigger points called V+ and V–; when the input voltage exceeds V+ the output will go low and when it is less than V– the output swings high. By feeding the output back to a capacitor at the input the capacitor will be alternately charged and discharged between the two trigger points.

Clearly the frequency of the oscillator is governed by the time constant of the resistor and capacitor combination, eg, a larger resistor or capacitor would mean that the capacitor would take longer to charge and hence reduce the frequency. The 1MΩ potentiometer is in fact the front panel SPEED control and with the circuit values used gives a frequency range of about 1Hz to 50Hz.

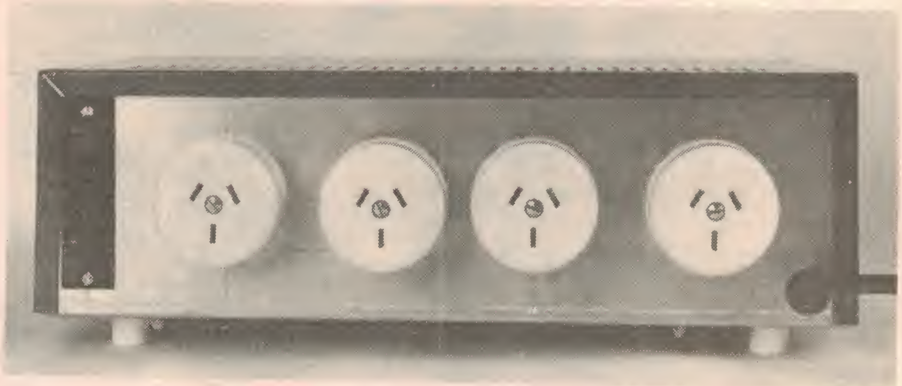
The chaser can also be clocked along with the beat of the music by switching S2 to the MUSIC position. In this case the clock signal is taken from IC1c which is wired as a Schmitt trigger and its input comes from the rectifier output of the 200Hz low pass filter. When the low frequency signal amplitude rises above the upper trigger point of the Schmitt IC1c, the chaser will shift along. The amplitude must then pass below the lower trigger point to reset the Schmitt. In practice, the sensitivity control has to be adjusted for best results.

An oscillator similar to IC7a is used in the AUTO circuit to automatically reverse the direction of the light chaser. The AUTO oscillator is IC7f which also uses a 1MΩ potentiometer functioning as the AUTO speed control but the time-constant is longer because of the 22μF capacitor used. Switch S3 is connected to the input of the oscillator and it can force the input high or low, while the centre-off position allows the oscillator to function. This corresponds to forward, reverse and auto operation.

Output of the oscillator is fed to the data input of IC9a which as we mentioned above controls the direction of the chaser. The clock input of the flipflop comes from IC7e which inverts the zero crossing signal fed to IC9b. Since both flipflops are clocked on the positive transition of their clock inputs, IC9b will be clocked on the positive transition of the zero crossing signal and IC9a on the negative transition. This merely ensures that the mode control of the shift register does not change at the same time as the register is clocked.



Above: the heatsink operates at mains potential so make sure that you fix warning signs to it. Below is a rear panel view of the unit.



Looking now at the zero-crossing detector, the mains signal is obtained from one side of the secondary of the transformer and clipped via the 100kΩ series resistor and diodes D5 and D6 to ±12V and fed to the input of comparator IC3. The 100kΩ and 100Ω resistors connected from the output to the non-inverting input and ground provide some hysteresis, improving stability.

The result is a square wave output in phase with the mains, but what we require is a brief positive pulse at the start of each half-cycle. This is accomplished by further squaring the signal with another Schmitt inverter, IC7c, which drives IC4c, a 4030B exclusive OR gate. One input receives the square wave signal directly while the other input is connected via a 100kΩ resistor and .01μF capacitor so that it is slightly delayed. Now since the output of the XOR gate will be high only while its two inputs are at different logic levels a brief high pulse will be generated at the start of each half-cycle and the width is set by the time constant of the resistor and capacitor to 0.7ms.

The zero crossing pulse is also used to reset the ramp generator which consists of a 0.1μF capacitor and two 22kΩ resistors in series. The brief pulse charges the capacitor via diode D7 which is then reverse-biased when the zero-crossing signal goes low leaving the capacitor to discharge via the 22kΩ resistors. This results in an exponential decay but as we mentioned earlier the ramp function must take into account other factors such as the firing angle versus light output.

A reasonable relation between light output and apparent sound level was obtained by using IC4b and IC4d. These two XOR gates work in the same way as

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We used red, yellow, green and blue flood lights for a dramatic colour display. Maximum load is 600W per channel.

IC4c except that because of the longer time constants used their pulse widths are 1.6ms and 3ms respectively. The outputs are then resistively mixed with the exponential decay waveform to yield the required ramp signal.

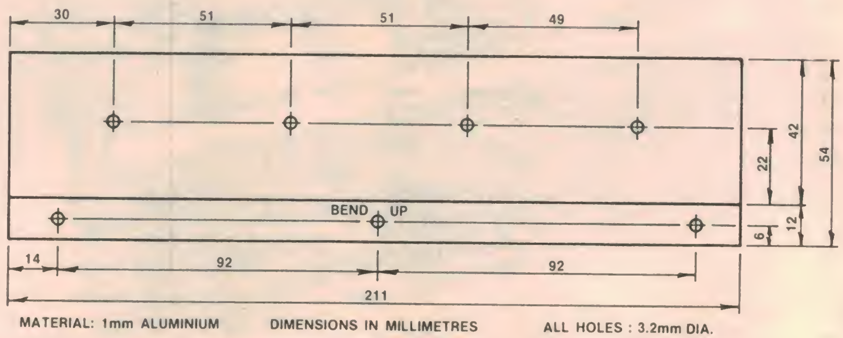
Referring back to IC8, the demultiplexer, regardless of whether the Musicolour or Chaser section is selected, the signal passes to the four outputs of the 4019B where each output drives a 390Ω resistor in series with a front panel LED and then the internal LEDs of the MOC3021 Triac-triggers, IC10 to IC13.

At the time of writing it appears that the MOC3021 is not quite as readily available as the MOC3020 which is similar in all respects except that it requires a higher LED current to ensure that the silicon bilateral switch is latched. Due to the limited current available from the CMOS driver IC8, some low spec MOC3020s may not work. Nevertheless we used MOC3020s in our prototype without any problems so if you cannot obtain MOC3021s then MOC3020s should prove suitable.

The Triac-trigger is connected between terminal A2 and gate on Triacs Q1 to Q4 which are all SC141D 6-amp devices. A 680Ω resistor in series with each Triac-trigger limits the repetitive surge current to a safe value of about 0.5 amps. Finally the switched outputs from the Triacs are taken to mains sockets on the back of the unit along with neutral and earth connections.

Since all four outputs could be full on in at least one operating mode, the recommended maximum light load is limited not by the rating of Triacs but by the 10-amp rating of the power point, ie, 600W per channel or 2400W total.

Power for the unit is obtained from a simple voltage doubler consisting of a 12V transformer, two 1N4002 rectifier diodes and a capacitive filter. This is followed by an LM340T-12 positive 12V regulator and an LM320T-12 negative 12V regulator to generate ±12V. Tantalum capacitors on the outputs provide high frequency decoupling and stability while 0.1μF capacitors distributed around the board provide additional decoupling.



This metalwork diagram gives the dimensions of the aluminium heatsink.

CONSTRUCTION

Looking at the construction now, most of the components are mounted on a single PC board coded 81mc8 and measuring 211 x 175mm. Use the component overlay diagram as a guide to mounting the components and in particular note the orientation of the diodes, electrolytics, regulators and ICs. To avoid damage to the CMOS ICs due to static electricity use an earthed soldering iron and solder the IC supply pins first to enable the internal protection diodes.

The four Triacs are all mounted on one heatsink without insulating washers as the heatsink also acts as the connection from the mains active line to the A2 terminal of the Triacs via their mounting tabs. The heatsink can be fashioned from a sheet of 1mm thick aluminium folded into an L-shape as shown in the accompanying diagram. Mount the heatsink onto the board with three screws then bolt the Triacs to it.

We housed our unit in a K&W case Model C1284 which consists of a U-shaped aluminium base and steel cover. Drill holes in the rear panel for the mains sockets, mains entry hole and speaker terminal. As a guide the sockets should be mounted with centres approximately 60mm apart and 45mm up from the base. When mounting the speaker socket make sure that it does not interfere with the cover.

The electret microphone insert that we've used is quite inexpensive and readily available from most retailers such as Dick Smith Electronics and Jaycar. It is mounted on a rubber grommet on the bottom of the chassis and positioned about 15mm back from the front panel (see photograph). The rubber grommet provides a suitable mounting and also some acoustical isolation from the case. We would however recommend that a less rigid mounting such as foam rubber be used in more demanding situations.

Scotchcal front panels should be available from most kit suppliers. Alter-

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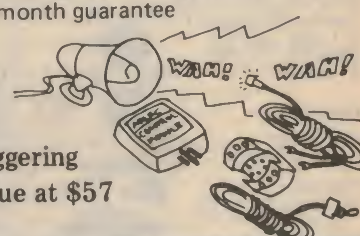

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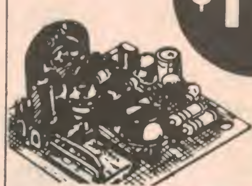

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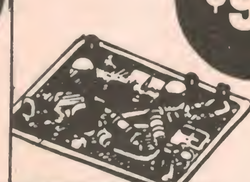

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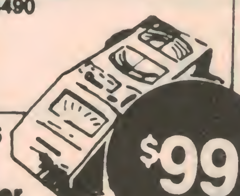

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natively, the half-size artwork shown elsewhere in this article can be used to produce one. Usually the Scotchcal panel as supplied will not be cut to shape so use a ruler and a sharp knife to scribe along the border of the panel and then bend the Scotchcal back and forth along the border to obtain a clean break – note this is much faster than actually cutting all the way through with a knife. Note that the Scotchcal panel should be sprayed with clear lacquer and allowed to dry before affixing to the chassis.

After affixing the Scotchcal to the front panel drill mounting holes from the Scotchcal side of the panel being careful not to lift the Scotchcal. Mount the LEDs, switches and potentiometers then hold the PC board and transformer in the chassis to obtain drill centres for their mounting holes. The board can be mounted on the chassis using 6mm tapped spacers or plastic board supports and the wiring completed using the wiring diagram. To simplify wiring and for a neat appearance we would recommend that PC board pins be used.

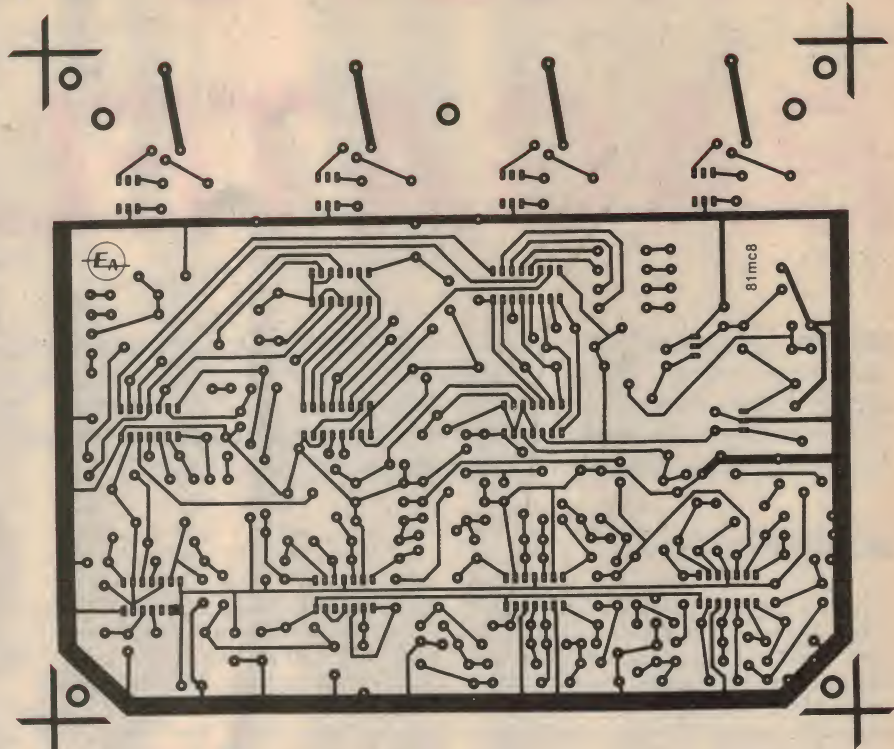
The LED bezels we used were of an attractive one piece plastic construction and relatively cheaper than "chrome" types. Nonetheless these LED bezels are quite expensive, and we would suggest that normal red LEDs and separate LED mounting bezels be used.

The mains cable should enter the unit through a grommeted hole and be securely clamped. Terminate the active (brown) and neutral (blue) wires in an insulated terminal block and solder the earth wire directly to a lug bolted to the chassis. Wiring to the back panel mains sockets should also pass through grommeted holes and only mains rated cable should be used. Apart from the connection to the mains socket the only other mains connection to be made is to the heatsink. This is accomplished by connecting a wire from the mains active to a lug placed on the mounting screw of one of the Triacs.

While most of the Musicolour circuitry is at a safe earth potential, the heatsink and Triacs are at mains potential. So just to emphasise this and avoid any carefree approach to the unit we would strongly suggest that you fix warning signs to the heatsink (see photographs of our unit). The artwork for these signs is shown elsewhere in this article and it can be photocopied and attached to the heatsink with double-sided tape.

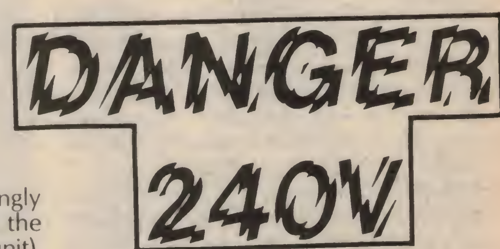
With all the wiring completed recheck the wiring and component placement or better still have someone else check it. If you are satisfied that all is well switch the unit on, switch to chaser mode, select the first pattern and press the load button with the MUSIC/OSC switch set to OSC. The front panel LED display will now show the chaser operation with the LEDs turning on and off in sequence. You should be able to readily verify that the other functions work.

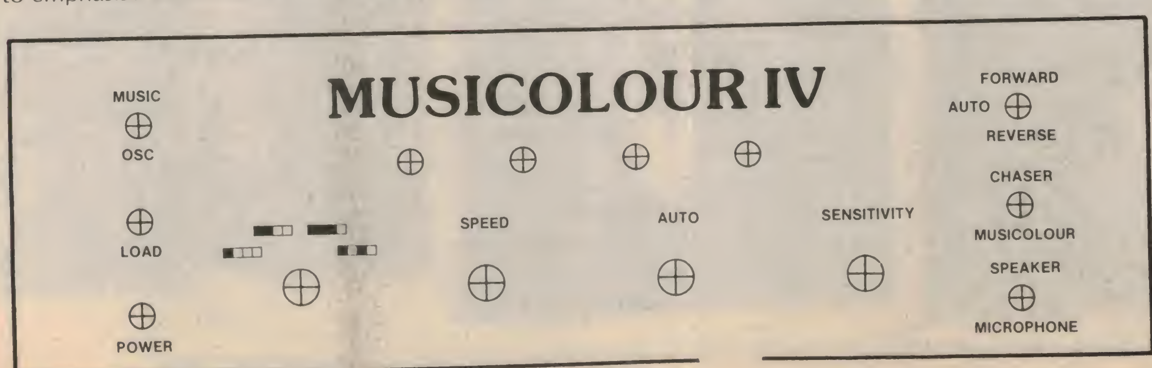
If there are any problems, however, then disconnect the mains active lead to the heatsink at the terminal block and also the neutral lead going to the mains sockets. With these disconnected the board should be safe to work on.



Above is a half-size reproduction of the printed circuit board. Finished boards and front panels are available from the usual retail outlets.

Right: make two copies of this warning sign and attach it to the heatsink with double-sided tape. ►





Left: half-size reproduction of the front panel artwork.

PAVLOV'S BAGATELLE

BEAT THE TIMER & WIN A "SMARTIE"

NOTE SMARTIE IS A TRADE NAME OF ROWNTREE HOADLEY LTD

Ideal for occupying the time of children (and young-at-heart adults) on cold wet days, "Pavlov's Bagatelle" is a game that involves skill, a steady hand, strong nerves and a certain amount of patience. To increase the excitement, a novel confectionery dispenser provides a reward for those who win the challenge against the clock.

by JOHN CLARKE

You are playing one of the latest electronic games. Perspiration drips from your forehead and, after a remarkable display of concentration, you win. What happens? Do you get a pat on the back, a ticker-tape parade or even a letter from the Queen? No! – absolutely nothing happens. It's all a complete anticlimax, so what was the point of winning? Don't you wish for something more?

Well now this situation has changed. Pavlov's Bagatelle (we'll explain the name later) is a game that takes advantage of one of psychology's finest principles – the reward system. At last we have a game that gives satisfaction to the winner!

Mechanical versions of Bagatelle invariably consist of a round flat container with a transparent top, inside which a small ball rolls around. The object of the game is to manoeuvre the ball into a hole at the centre of the container. However, because the ball is very light and both it and the surface over which it rolls are extremely smooth, it is difficult to control the direction of the ball. Even if one does manage to intercept the hole, the ball usually jumps back out again, since the hole is quite shallow!

Other versions of the game employ two or more balls, and these have a habit of jumping out of their respective holes just as the last ball is about to drop into place. Normally sane, placid human beings have turned into frothing Neanderthals from the frustration. What better than to produce an electronic version of such a fiendish contraption?

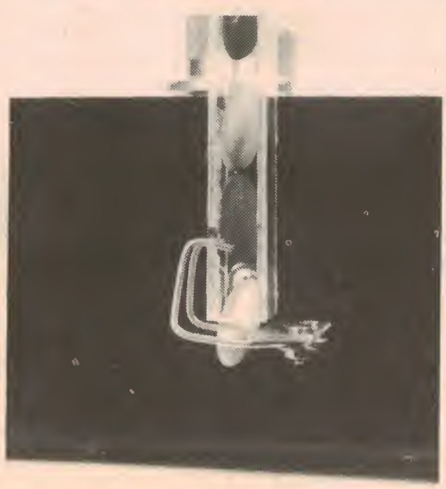
Our electronic version of the game uses LEDs to represent the ball. Four red LEDs – arranged north, south, east and west – are used to represent the rolling ball, while a single green LED represents the ball when it is in the hole. To add to the excitement, we have incorporated a timer so that the ball must be centred in the hole – ie the green LED lit – within a certain time in order to win.

But the ultimate feature providing the incentive to win is – wait for it – the "Smartie" dispenser. If after the extreme mental and physical effort involved, racing against the clock, you finally win, a sugar coated chocolate is dispensed to provide you with an enjoyable snack and to refresh you for the next onslaught.

It was this reward which prompted us to name the game after Pavlov, in memory of his famous experiment involving behavioural conditioning. After subjecting a dog to food and a ringing bell (conditioning), he found that the dog would salivate (conditioned response) as soon as it heard the bell ring, even though no food was offered.

Psychologists amongst our readers will probably point out that Pavlov was the pioneer of Classical conditioning whereas our game really is an example of Operant conditioning whereby a reward is used to partially reinforce behaviour. The pioneer of this work was B. F. Skinner but we couldn't very well call this project "Skinner's Bagatelle" could we? Everyone has heard of Pavlov and his dogs, so Pavlov's Bagatelle it is!

The general arrangement of the game controls can be seen in the photographs. First we have an on/off switch which is self explanatory. At the centre of the control panel is the "ball", depicted by the 5 LEDs and below this a joystick to control the "ball" position. To the right of the joystick is the Start Timer switch which initiates the timer, the clock against which you must race to place the ball in the hole.


The "Smartie" dispenser in action. It is designed to release only one "Smartie" for each operation.

All you have to do is light the green "hole" LED and beat the timer. Game can be made easy or difficult by adjustment of Handicap and Time controls.

Two potentiometer controls at the top of the panel adjust the game to the desired level of skill. The Time control gives adjustable clock times from virtually instantaneous to about 10 seconds, while the Handicap control adjusts the degree of difficulty of locating the ball in the hole. The game can either be simple to play, with easy location of the ball in the centre of the hole and a long time in which to do it, or the game can be virtually impossible if a short time is combined with a difficult handicap setting.

One time setting which has no external control but which is still important is the time required for the ball to be in the hole before a "Smartie" is dispensed. This time setting prevents a "Smartie" from being dispensed if the hole is found only momentarily.

Although various commercial dispensers are available, we have yet to see one suitable for "Smarties". Consequently, as part of this project, some mechanical construction is necessary to produce a hand-made "Smartie" dispenser. Producing this is not too difficult and sufficient details are given in the constructional section to enable you to fashion a reliable unit.

THE CIRCUIT

The circuit can be divided into two sections: the Bagatelle section itself, consisting of a 4136 quad op amp package, the five ball LEDs and a joystick; and a solenoid driver section. We shall look in detail at the Bagatelle circuit first.

The Bagatelle section consists of two "window" comparators formed by the IC1a/IC1d and IC1b/IC1c pairs. We shall only discuss the operation of the IC1a/IC1d pair as the two circuits are identical.

Both op amps are connected as comparators, so the output of each op amp is either high or low. When the voltage at the non-inverting input of the comparator is higher than that at the inverting input, the output is high. Alternatively, when the voltage at the non-inverting input is lower than the inverting input, the output is low.

As can be seen, the inverting input of IC1d is tied to the positive supply rail via a 47kΩ resistor, while the non-inverting input of IC1a is connected to the negative rail via another 47kΩ resistor. Between the two inputs is a 100Ω trimpot and the Handicap potentiometer. These components and the 47kΩ resistors form a voltage divider which sets the window voltage.

The window voltage can be varied simply by varying the Handicap potentiometer — ie the voltage between the non-inverting input of IC1a and the inverting input of IC1d is varied. Similarly, the two remaining inputs on IC1a and IC1d are wired to the wiper of the joystick control potentiometer, which forms a second voltage divider. This potentiometer is used to control the ball position.

The output of each op amp is used to drive the ball position LEDs via 1kΩ current limiting resistors. With regard to the north and south LEDs, there are three possible conditions: the north LED is on when the voltage at the non-inverting input of IC1d is higher than the voltage at the inverting input; the south LED is on when the inverting input of IC1a is lower than the non-inverting input; and neither LED is on when the voltage between the directly connected non-inverting input of IC1d and the inverting input of IC1a is between the voltage at the inverting input of IC1d and voltage at the non-inverting input of IC1a.

In other words, the red LEDs are off when we are within the "window" voltage.

PARTS LIST

1 printed circuit board, coded 81sm7, 102 × 69mm
1 Scotchcal front panel
1 plastic utility box, 196 x 113 x 60mm
1 SPST miniature toggle switch
1 momentary contact pushbutton switch
1 100kΩ joystick potentiometer
1 1MΩ linear potentiometer
1 1kΩ dual-ganged linear potentiometer
1 216 9V battery and battery clip
2 knobs (to suit)
1 6V solenoid (see text)
33 metres of 0.16mm (34 B&S) enamelled wire (see text)

SEMICONDUCTORS
1 4136 quad op amp IC
1 741 op amp IC
2 555 timer ICs
2 BC548 NPN transistors
1 BC338 NPN transistor
5 5mm red LEDs and bezels
1 5mm green LED and bezel
1 1N4002 rectifier diode
3 1N4148 small signal silicon diodes

CAPACITORS
1 2200µF 16VW axial electrolytic
1 100µF 16VW PC electrolytic
2 10µF 16VW PC electrolytics
1 4.7µF/16VW PC electrolytic
1 0.1µF metallised polyester
1 .01µF metallised polyester

RESISTORS (¼W, 5%)
1 x 1MΩ, 3 x 100kΩ, 4 x 47kΩ, 1 x 33kΩ, 6 x 10kΩ, 1 x 4.7kΩ, 9 x 1kΩ, 1 x 100Ω, 2 x 100Ω large vertical trimpots.

MISCELLANEOUS
Scrap aluminium, PC stakes, nuts, screws, washers, stiff wire, spacers, rubber feet, etc.

NOTE: Components specified are those used in the prototype. Capacitors and resistors with higher ratings may be used provided they are physically compatible.

There is one other possibility and that is that both LEDs can be on at the same time. Since the ball cannot be in two places at the same time, this possibility must be eliminated. The 100Ω trimpot achieves this by maintaining a minimum window voltage between the two op amps.

It can be seen that moving the N-S section of the joystick controls the vertical ball movement, while the other section of the joystick controls horizontal movement. The on/off state of the red LEDs tells us whether or not the ball has rolled to a given side of the hole. If all the red LEDs are off then the ball is in the hole.

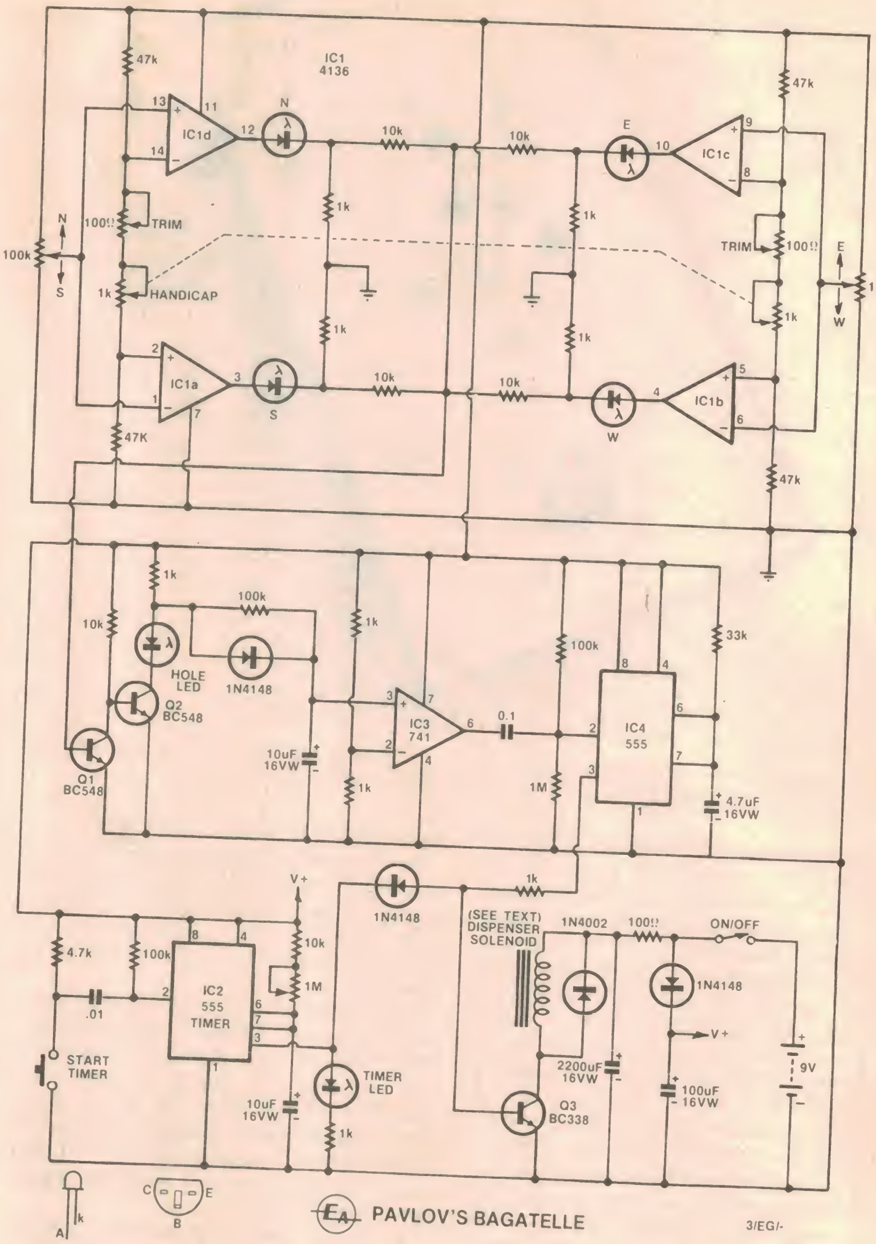
Increasing the resistance of the dual-ganged Handicap potentiometer increases the window voltage, giving greater joystick movement with the LEDs remaining off. In other words, a larger movement of the joystick is necessary to switch between opposing LEDs. This gives us control over the degree of difficulty of the game – the greater the window voltage the easier the game is to play.

When all four pointer LEDs are extinguished, the green centre LED comes on to indicate that the player has succeeded in manoeuvring the ball into the hole. The hole is detected as follows: a 10kΩ resistor is connected to the cathode of each of the four red LEDs, with the other side of each resistor connected to a common point. If a LED is on, the voltage at this point will go high, turning on Q1 and holding Q2 and the green "hole LED" off.

If, however, the red LEDs are subsequently extinguished, the base of Q1 is driven low and transistor Q2 turns on via its 10kΩ base resistor. This in turn drives the green LED to indicate that the ball is in the hole.

The second section of the circuit is relatively straightforward, and consists of three timers and the solenoid driver circuit. IC2 is a 555 monostable timer and is the clock you play against when the game is played. The timer is initiated with the Start Timer pushbutton which produces a negative going pulse at pin 2, the trigger input of IC2. Upon triggering the output, pin 3 goes high for a set period dependent upon the setting of the 1MΩ timer pot. This output drives the timer LED to indicate that timing has commenced.

IC3 is wired as a comparator, the input of which is connected to a time constant network consisting of a 10μF capacitor, 100kΩ resistor and a diode. Initially, when the hole LED is off, the voltage at the anode end of the diode is high and the 10μF capacitor charges quickly via the diode. When the hole LED comes on, the diode is reverse biased and the 10μF capacitor begins to discharge through the 100kΩ resistor. When the voltage at the non-inverting input of IC3 goes below the voltage set by the 1kΩ/1kΩ resistor voltage divider, the output of the comparator goes low.



The circuit consists of two window comparators (IC1a/IC1d and IC1b/IC1c) for the Bagatelle section, together with three timers and a solenoid driver circuit.

This time constant prevents the game from being too easy; the hole LED has to be on until the comparator changes to a low state before it is possible to win the game. If the hole is found for a time less than the time constant, then the capacitor will quickly charge again through the diode when the hole LED goes off.

When the output of IC3 goes low a pulse is sent to the trigger input of IC4, another 555 monostable timer, via a 0.1μF capacitor. This timer has a short time constant, about 150ms, and provides a short pulse to transistor Q3 to drive the solenoid. The duration of the pulse has been kept deliberately short to minimise battery consumption.

Note that for Q3 to turn on, there is an AND situation, whereby the outputs of both IC2 and IC4 must be high. If the output of IC2 is low, indicating that the time for the game has expired, the diode between it and the base of Q3 will hold off Q3 regardless of the output of IC4. Similarly, if pin 3 of IC2 is high but the output of IC4 is low, Q3 cannot turn on, because the diode will now be reverse biased. So Q3 will not come on unless

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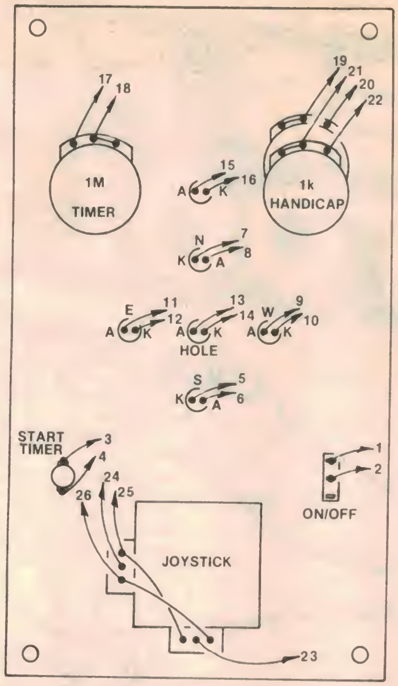
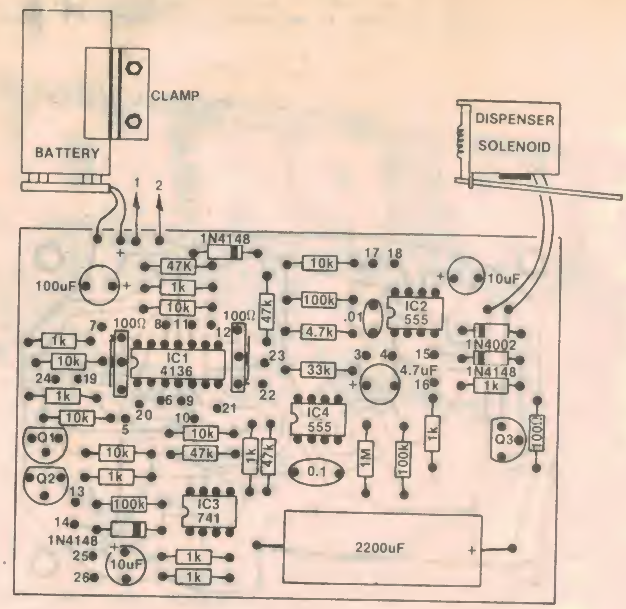




both the hole LED and timer are on.

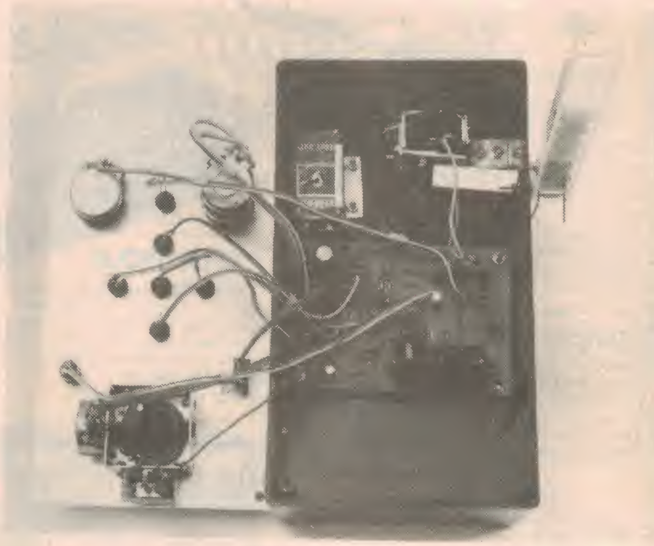
Current drive for the solenoid is supplied by a 2200μF electrolytic capacitor which is charged via a 100Ω resistor connected to the positive rail. This is necessary because the battery alone cannot supply the necessary peak current. Power for the remainder of the circuit is supplied via a 1N4148 series diode and filtered by a 100μF electrolytic capacitor. The arrangement is such that when the solenoid is activated, and the voltage at the anode end of the diode momentarily drops below the cathode voltage (ie diode reverse biased), the 100μF capacitor will keep the supply voltage intact for the rest of the circuit.

All that remains to discuss is the operation of the "Smartie" dispenser. Fig. 1 shows the basic principle. A square-section tube holds the "Smarties" in a stack end to end and they are prevented from falling out by a gating piece across the opening at the bottom of the tube. This gating piece is connected to the solenoid which, when activated, moves the gate away the tube opening to allow one of the "Smarties" to fall.

To prevent more than one "Smartie" from escaping at one time, an escapement is used to block the next "Smartie" in succession further up the tube.

When the solenoid is released, the gate again covers the exit of the dispenser tube and the escapement releases its hold on the next "Smartie". The "Smartie" then falls to the bottom of the tube, ready to be dispensed when the gate reopens.

Above and right: follow this wiring diagram and inside view when constructing the game.



CONSTRUCTION

Construction of the game is relatively straightforward, although a certain amount of patience is required to produce a reliable "Smartie" dispenser. Most of the components are mounted on a printed circuit board (PCB) coded 81sm7 and measuring 102 × 69mm. The board, along with the solenoid, LEDs and various other controls, is housed in a plastic utility case (196 × 113 × 60mm).

Start construction by soldering all the resistors and diodes in position on the PCB, followed by the trimpots and capacitors. The ICs should be mounted last of all, and each lead should be quickly soldered to prevent possible heat damage. Follow the overlay diagram carefully and pay particular attention to polarity-conscious components (ICs, transistors, electrolytic capacitors and diodes).

We recommend that you use PC stakes for all external connections to the board. Once the board is completed, it can be mounted in the case as shown in the internal photograph.

Holes for the LEDs, switches and potentiometers can now be drilled in the lid of the case using the front panel artwork as a drilling guide. This done, the front panel components can be mounted in their respective positions and the wiring to the PCB completed. We used pop rivets to hold the joystick to the lid, although screws and nuts could also be used.

The solenoid used in our prototype was obtained from Radio Despatch Service (869 George St, Sydney) and is a 6V type. At the time of writing, Radio Despatch Service has at least 50 of these in stock at a cost of around $1 each. Once stocks of these are depleted there are only 24V types available which,

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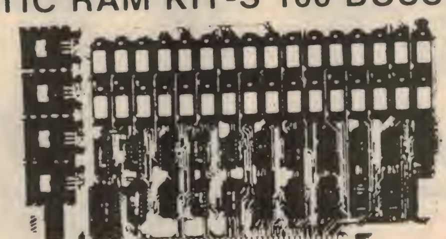

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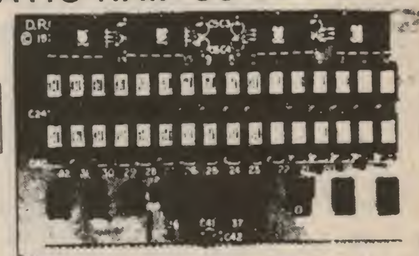

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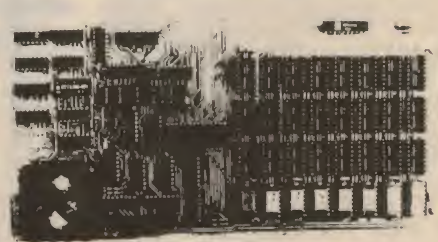

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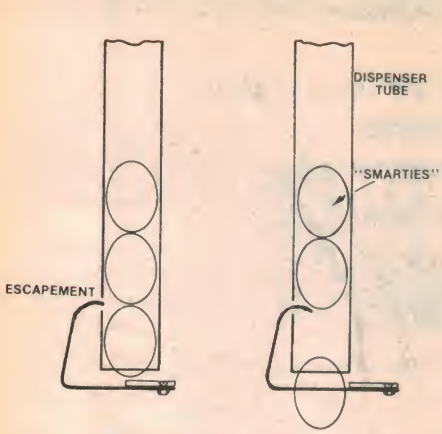


Fig. 1 DISPENSER IN OPERATION

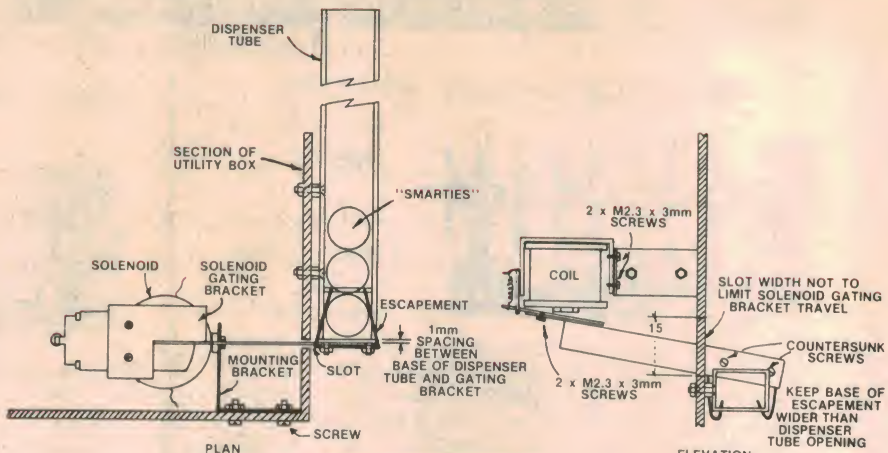


Fig. 2 GENERAL VIEWS OF DISPENSER

although unsuitable in their present form, have the same physical dimensions as the 6V type. These 24V solenoids have to be rewound for 6V operation.

First, remove the coil bobbin from the U-shaped metal bracket by drilling out the retaining rivet. The existing coil is then removed either by unwinding it by hand or, more conveniently, cutting through the coil with a sharp knife (the wire is very fine).

The bobbin is rewound with about 900 turns of 0.16mm (34 B&S) enamelled wire. This is best done using a hand drill, with the coil bobbin held in the chuck. Try to wind the coil as evenly as possible, keeping each winding adjacent to the previous one, in order to obtain maximum coil flux. Finish off the coil with a layer of insulation tape.

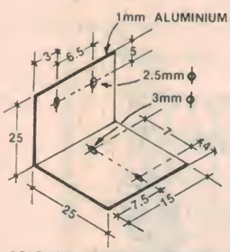
Fortunately, the bobbin has a 3mm tapped thread immediately behind the retaining rivet, so a 3mm machine screw and washer can be used to resecure it to the bracket. When replacing the striker plate, adjust the spring tension by bending the tabs inwards until there is just barely tension when the striker plate is open. This reduces the force required to close the solenoid.

While we have not tried it, it may be possible to modify other relays in a similar manner.

Constructional details for the "Smartie" dispenser are shown in Figs. 2 & 3. The dispenser tube can be made from various materials, such as aluminium, perspex or stiff cardboard. We used clear perspex for our prototype so that the "Smarties" could be seen inside the tube.

Each side of the dispenser tube was made by cutting a perspex sheet with a fine-bladed hacksaw and carefully filing each edge to a smooth finish. Two countersunk mounting screws are then secured to one of the pieces which are glued together using epoxy cement.

If you elect to make the tube out of



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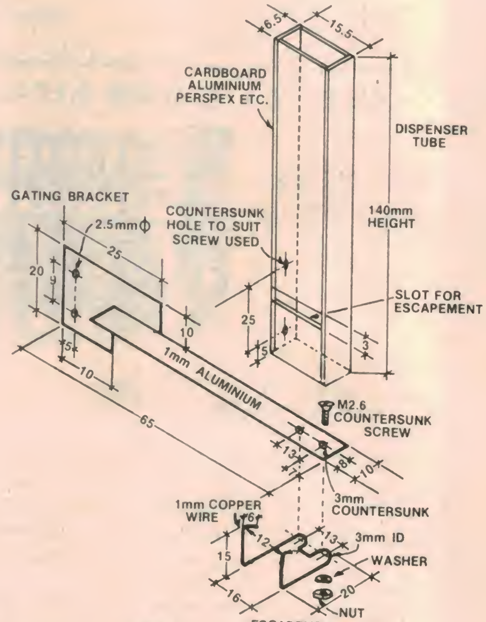
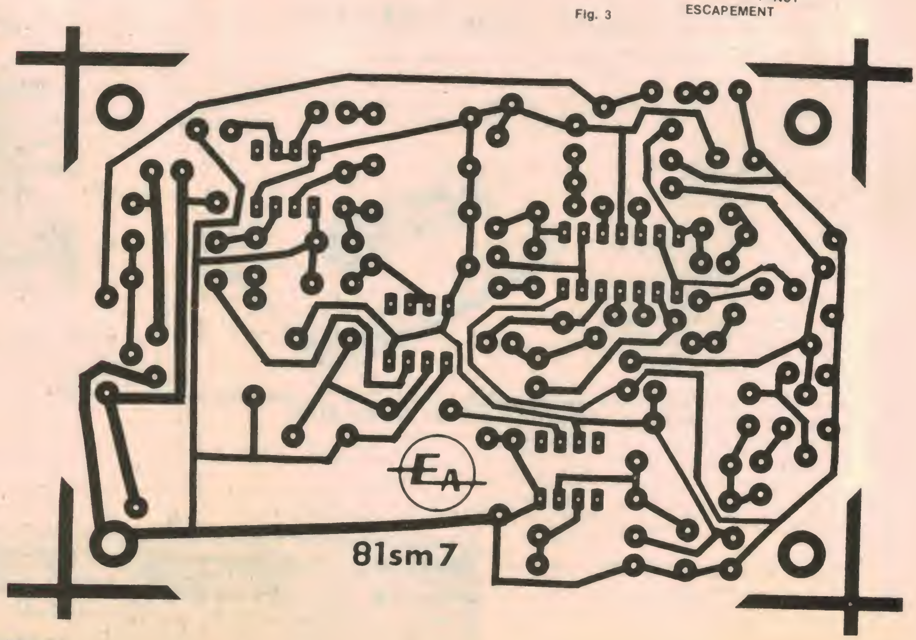


Fig. 3

Below is an actual size reproduction of the PCB artwork.



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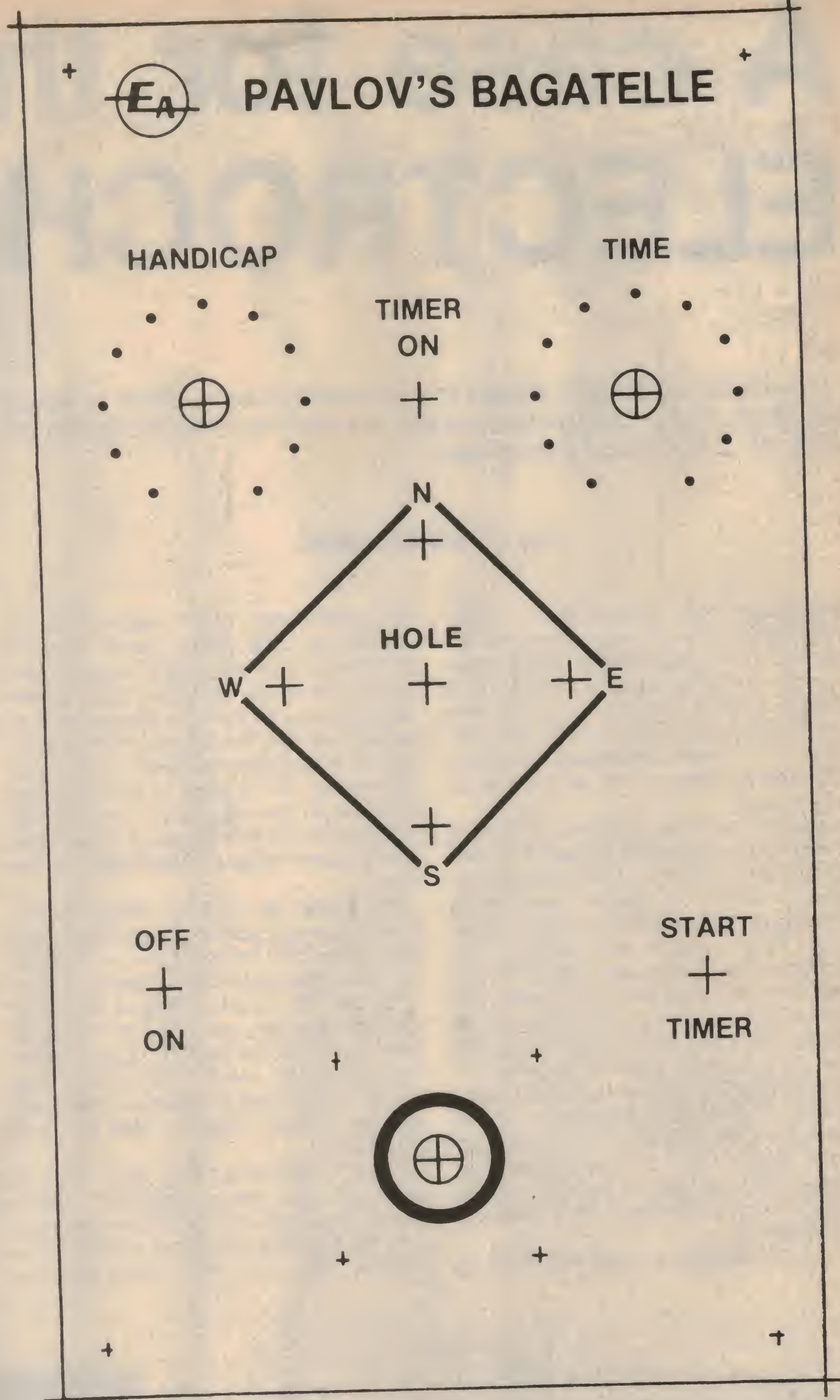

Actual size reproduction of the front panel artwork.

aluminium, the whole piece can be folded into shape, not forgetting to countersink and secure the two mounting screws before bending. To obtain a straight edge the aluminium can be scored to say one quarter of its thickness. The three bends can then be made by hand.

Fig. 3 also shows the dimensions of the escapement which is bent up from a short length of 1mm-diameter tinned copper wire. Some final touching up of the bends may be required after the project has been completed in order to achieve satisfactory dispenser operation. A small right-angle bracket is used to mount the solenoid.

As can be seen from the photographs, the dispenser and solenoid are mounted in the top right hand corner of the case. Attach the solenoid mounting bracket to the solenoid using two 2.3mm machine screws (the holes in the solenoid are already tapped), and then bolt the solenoid to the case. The position of the slot for the gating bracket can now be determined. Drill a few holes in line where the slot should be and then file the slot to shape.

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Another two 2.3mm screws are used to secure the gating bracket to the solenoid striker plate, again using pre-tapped holes. Once the solenoid and gating bracket are in position, the position for the dispenser tube can be determined and the appropriate mounting holes drilled. The base of the tube should be positioned 1mm above the gating bracket, such that the gating bracket just clears the tube opening when the solenoid is activated.

Note that the dispenser is stood off the edge of the case by about 4mm using nuts and washers to act as spacers.

With everything in place, the dispenser is ready to be tested. Operate the solenoid by hand at first, to make sure that the escapement does not foul when passing through the slot in the dispenser tube. Also, check that the escapement wires allow a complete opening at the base of the tube when the solenoid is closed.

You are now ready to try the dispenser out with some "Smarties" (you could call it "the 'Smartie' test"). The dispenser has been designed for a tight fit so that the stacked "Smarties" will not lay skewed in the tube and thus upset dispenser operation. Consequently, a few "out of tolerance" "Smarties" will be too large to fit in the dispenser tube and these can be discarded in any manner you see fit! It is here that the escapement may require some tweaking for satisfactory operation.

You are now ready to test the game for correct operation. Connect the solenoid leads to the PCB, install the battery and switch on. Check to see that all the ball LEDs light when the joystick control is manipulated and that the timer LED lights when the Start Timer button is pressed. Assuming that all is well, all that remains to do is to adjust the two trimpots associated with the Handicap control.

First, adjust the Handicap control fully clockwise. The N-S trimpot should now be adjusted so that the north LED goes out just as the south LED comes on (and vice versa). Ignore the E-W LEDs during this operation. Once this is done, the E-W trimpot should be adjusted in similar fashion.

Just one final point. Some readers may have realised that, in moments of desperation, it is possible to retrieve the "Smarties" simply by tipping the dispenser tube upside down. But that would be cheating and we're not going to let temptation get the better of us, are we?

A case for the ELECTROCHUNE

This month we present details for a suitable case in which to house the single board Electrochune organ. As well we have produced artwork for a Scotchcal front panel.

by JOHN CLARKE

Although the Electrochune organ presented last month was capable of being used in its single board form, by now you are probably looking around for a suitable case in which to house it. The case should be solid enough to withstand the rough treatment expected from young children and also be an attractive unit.

We think we have met both these aims as well as producing a case which is simple to build. The low profile design provides economy of timber used while allowing the PC board to fit snugly inside with little space to spare. The "keyboard" protrudes from the lid of the case and sits flush with the sides and front of the case. This can be seen in the photos. The PC board is supported at the front with a piece of wood packing.

Our prototype case was made from a piece of 12.5mm chip board with overall dimensions 300 x 300mm. The base was made from a 266 x 275mm sheet of Masonite. On the lid are mounted all the controls with a Scotchcal label covering the entire lid.

Using the diagram to help you mark up the dimensions, start construction by cutting the chip board pieces to size. These can be filed to the exact dimensions with a rasp or coarse glass paper. The best way to trim the side pieces is to support all four lengths together side by side in a vice and file them to the same dimension. The lengths of each pair can be done in the same way. The chamfer at the front of the lid piece is optional, but it does enhance the looks of the case.

The holes can now be drilled for the potentiometer shafts to protrude and the rectangular holes for the switches filed. Now the lid can be tested for a neat fit to the PC board. It should be noted that the switches will need to be raised from the PC board with PC stakes so that the top of the switch will fit flush with the lid. With some final adjustments with the file, you are ready to glue the case together.

Use PVA wood-working glue to connect all the pieces together. These should be lightly clamped while the glue sets. Be sure that the pieces are correctly located while the glue is still wet, as once the glue dries, you will not be able to shift it. When dry, the case can be sanded to a smooth finish.

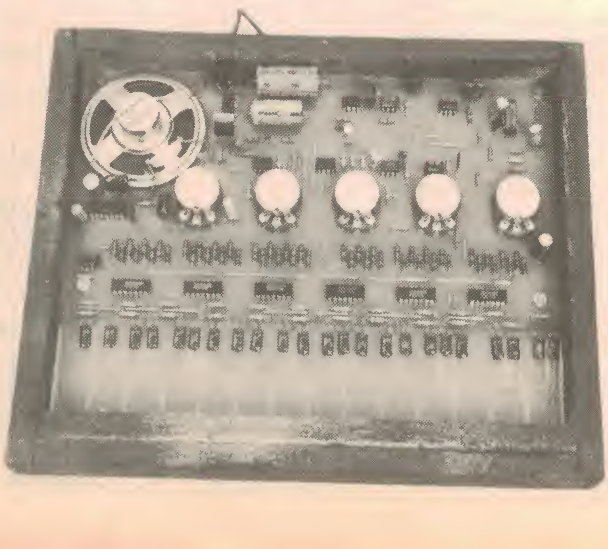
Placed the PC board in the case and mark the position of the PC board mounting holes on the inside of the lid. Now drill holes for the four small wood screws to attach the board to the lid. The Masonite base can then be cut to size and secured to the case with six countersunk wood screws.

A hole can be drilled at the rear of the case to allow the power cord to enter. Alternatively a socket could be incorporated and a plug attached to the plug pack supply. The case is now ready for painting. We used flat black paint although a coloured gloss paint could equally well be used. After painting, the Scotchcal panel, which should be coated with a clear lacquer such as Estapol, can be fitted.

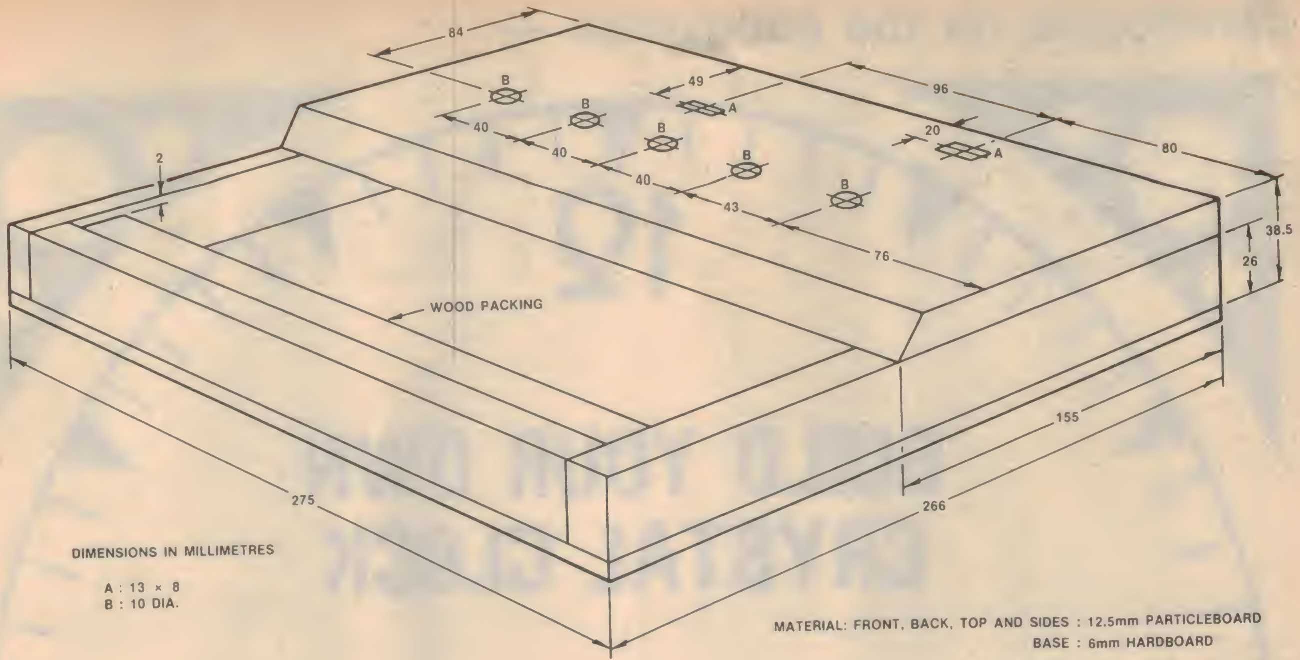
Secure the knobs, then plug the plug pack into the power point, turn the Electrochune on and the organ is ready to be played. We hope you like the final product.

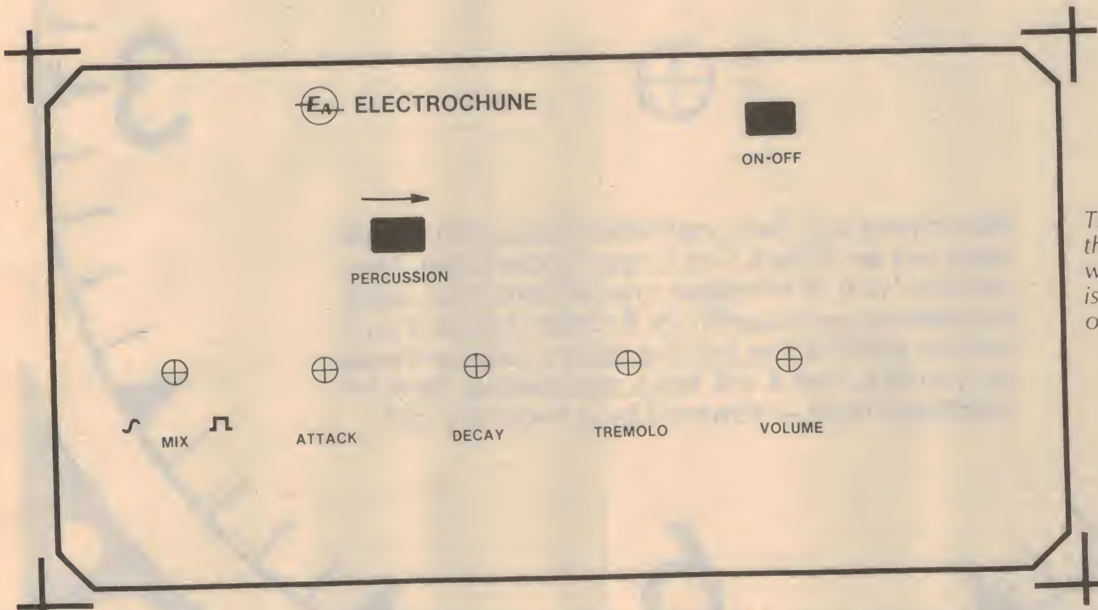
PARTS LIST

1 piece of 12.5mm chip board measuring 300 x 300mm
1 piece of Masonite measuring 266 x 275mm
1 Scotchcal label 275 x 143mm
10 10mm long wood screws
1 small quantity of PVA wood glue



The completed prototype, fitted with a Scotchcal front panel. Photo at right shows how the PCB is mounted in the case.





The above diagram shows the dimensions of the wooden case, while at left is a half-size reproduction of the front panel artwork.

Electronics for the handyman —

BUILD YOUR OWN CRYSTAL CLOCK

Not so long ago, the construction of a quartz crystal drive unit for a clock was a major undertaking. Now you can buy a complete crystal controlled clock mechanism, with hands, for $13.00. Mount it on a face as gimmicky as you like, or in a case as formal as you like, and it will keep near-perfect time for months on end — powered by a single dry cell.

Quartz crystal clock modules are now commonplace, of course, but mainly in built-up clocks in jewellers and department stores. They are much less common as an over-the-counter item, suitable for use in handyman situations.

That is why we reacted with interest when Jim Kaswadi of Amtex Electronics showed us a sample of a neat little clock movement which he was in a position to import. From distributors, it would sell for about $11.50 including sales tax. Where not directly available, Amtex could mail it to any address in Australia for an extra $1.50, making it $13.00 all-up.

An initial shipment has now arrived and, if you can't buy one through your normal supplier, send your order and $13 to Amtex Electronics, Suite 104, 11 Spring St, Chatswood, NSW 2067. Their telephone number is (02) 411 1323.

With the clock movement, Amtex will be supplying two sets of hands. The larger, plain hands suit the face shown above and measure 80mm from spindle to tip for the hour and sweep second hands and 58mm for the hour hand. The other set, more ornate and suitable for smaller, old-style clocks, has an hour hand measuring 54mm, spindle to tip, and an hour hand measuring 37mm. If a sweep second hand is required, the one mentioned above can be used and trimmed as necessary.

The module itself is intended for single-

hole mounting, much like a potentiometer. It can be mounted directly to, or behind the clock face, and packed as necessary to achieve a suitable spacing between hands and face. A rubber spacing washer is supplied for use as appropriate.

When fitting the hands, first make sure that the spindle of the minute hand is rotated so that the tiny "flat" will ultimately allow the hand to lie in the 12 o'clock position. Then press the hour hand into place, also lined up on 12 o'clock. Now fit the minute hand and lock it gently but firmly in place with one of the locking nuts provided.

If you plan to fit a second hand, use the ring locking nut, which leaves the second-hand spindle exposed. If a second hand is not required, use the dome locking nut for the minute hand, thus ensuring a neat finish.

When it came to illustrating uses for the clock movement, the imagination of staff members ran riot:

- Use the movement to reactivate some old period clock, maybe a grandather clock – if you can get your hands on one! The nearest we got to this suggestion was the old mantel model below.
- Obtain and frame a photographic enlargement of some historic tower clock but fit the movement behind it and make the hands work!
- Create a novelty for the children's room by mounting a photograph or the print of some storytime character, and adding clockhands in some appropriate position.
- Mount the hands on a full-face picture of the Moon and call the resulting masterpiece the "Lunatick"!

We settled for the much more prosaic and "electronic" course of preparing a pattern which could serve as the basis for a PC board. It could be etched on phenolic laminate or fibreglass – preferably one that does not have too obvious a trade mark on the rear surface. That is, unless you like back-to-front trademarks!

Burnish the copper lightly with steel wool and spray with clear, gloss lacquer to prevent tarnishing.

Another option, open to electronic types, is to produce a face on Scotchcal, again lacquering it to protect the finish.

Naturally, we assume that you will cover over the heading and opening par on the pattern, unless you really want to preserve the atmosphere of EA. In the vacant space, you can add your own gimmickry, a self pen-portrait, your signature, or a clipping from your letterhead.

FOOTNOTE: The clock is fitted with a crystal on 32.718kHz, which is divided down to give 1 pulse per second by means of CMOS dividers. Average drain at 1.2V is 300μA, with 30ms pulses, each second, of about 5mA. Operating life from a typical AA cell is about one year.

A new lease of life for an old family clock

Lots of people have them, tucked away in cupboards: interesting old clocks, passed down from grandparents, which could add interest to a room, if only they could be made to work.

As the Editor-in-Chief explains, he rather fancied this old clock, except for its loud ticking. A strip of aluminium and the module (below) fixed that problem once and for all!

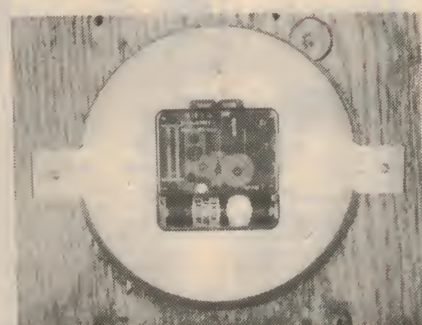
Just such a clock was the one illustrated above, which was unearthed in a shed, covered in grime. But, underneath the grime, I found a traditional oak clock, supplied by Saunders of Sydney, but made in America and date stamped 1913.

Some time later, I got to it, re-glued, sanded and polished the case, and restored the dial. Further work, including the provision of a pendulum bob restored the movement to working order, and the old clock took up where it had left off an unspecified number of years before.

As a timekeeper, it was no better or worse than the clocks I remember from my boyhood in the country, being affected both by temperature and by the tension of the main spring.

We came to accept that much by regarding the old clock as "right, give or take five minutes!". And we got round the persistent striking by letting the gong spring run down. But the loud ticking which, at times, could be passed off as "atmosphere", was intolerable when trying to concentrate on the soft passages in a modern recording.

So, when Jim Kaswadi of Amtex came up with a small quartz crystal clock movement for about $12, I decided that authenticity should give way to utility. We would store the old



brass movement in a plastic bag inside the clock for safekeeping, but leave it to the electronic movement to drive the hands.

No winding, no worries about accuracy, and barely audible ticking.

In fact, the whole job was done within the hour. A strip of 18-gauge aluminium was cut and bent so that it would support the quartz movement inside the cut-out behind the face. A single hole serves to mount the movement to the aluminium strip and the dimensions were such that the mounting nut was flush behind the face, leaving only the spindles to protrude.

Mechanically, the movement could have been mounted directly to the face but the hands would probably have been too far forward.

The hour hand supplied with the movement is a push fit. The minute hand slides over two tiny flats on its collar and is held by a small brass nut. Be very careful to locate the hand on the flats and to lock it gently but firmly into position.

One of the nuts supplied in the kit is dome-shaped and should be used if no second hand is intended. I used the alternative nut and fitted the second hand — with utility once again taking precedence!

Otherwise, the ornate hands supplied as alternatives with the movement, were reasonably in character and they are the ones pictured. Had it been necessary, it would probably have been possible to re-fit the original hands with the aid of some discreet bushing and pushing!

Check out these top value
DICK SMITH KITS

The advantages of building a DICK SMITH kit

Everything you need is supplied — parts, solder, even nuts and bolts. And most kits include detailed instruction manuals, making construction a breeze!

It goes together so easily: you don't have to be an expert to build a kit. Just follow the instructions!

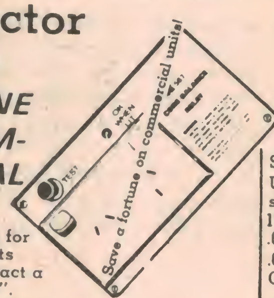
And it's finished. Sit back and enjoy your project. . . it looks so good and performs so well, your friends will never believe you built it!

PLUS OUR UNIQUE 'SORRY DICK IT DOESN'T WORK' GUARANTEE

Just in case you run into trouble (unlikely!) many kits include a coupon enabling service on your kit for less-than-normal service fee! So you cannot lose with a DICK SMITH kit.

Earth leakage electronic circuit protector

SAVE A FORTUNE ON COMMERCIAL UNITS!



This is a must for every hobbyists workshop. In fact a real "lifesaver". Senses any leakage to earth from a mains appliance (eg. through your body) — shuts off the power before it has a chance to electrocute you!

$49.50

Cat. K-3315 P&P $3.00

AUDIO OSCILLATOR

LOOK AT THESE FANTASTIC SPECS!

DICK SMITHS' EXCLUSIVE SILK SCREENED FRONT PANEL

Cat. K-3467
P&P $4.00

Super low distortion audio oscillator. Uses the new VMOS for greater stability. Specs: Freq. range — 15Kz to 150KHz. Distortion .003% Mid band .011% @ 100KHz, .024% @ 20Hz. Amplitude stability ±1dB. Comes with deluxe silk screened front panel!

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INFRA RED REMOTE CONTROL

Uses remote control to switch on and off any appliance within 10 metre range. Controls appliances up to 1200 watts.

Cat. K-3380 P&P $4.00

$63.95

Will negative ions improve your health?

find out with this ION GENERATOR

This easy to build kit breaks down dust and cigarette smoke particles. aids to a healthier and happier life. Comes complete with exclusive Dick Smith emitter head.

$37.50

Cat. K-3335
P&P $3.00

POOLS/LOTTO SELECTOR

K-3392

P&P $2.00

Picks numbers at random

$19.50

BENCHMATE

An indespensable tool for the bench. Combination 1W audio amplifier and 1.25 — 16V power supply @ up to 1A.

Cat. K-3470

$39.50

P&P $3.00

INFRA-RED BEAM RELAY

Pre-activated relay is set-off once beam is interrupted. Re-sets when beam is cleared. Ideal for burglar alarms, door minder etc. Use as camera trip, ideally suited to wildlife photography!

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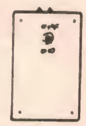


Cat. K-3375

P&P $3.00

IMPROVE YOUR CAR SOUND

Stereo Booster

Cat. K-3493

Add power & depth to your existing car stereo with this economical power package! 25 watts extra boost, and mounts easily under the dash!

$29.50 P&P $3.00

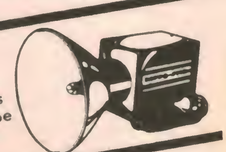
SPEED SENTRY

Allows you to pre-set to a certain speed and gives a warning signal if you exceed the set speed.

$11.75

Cat. K-3245 P&P $2.00

DISCOSTROBE



This is a must for any party! special PCB which makes it really simple to assemble. Provision has been made on the PCB, so that extra parts can be added simply and economically. Turn your next party into a disco!

$34.50

Cat. K-3152 P&P $3.00

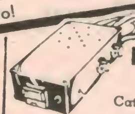
AUTOCHIME

Doorbell with automatic selection of 24 tunes. Runs off 240V so no flat batteries. Plays each tune in sequence.

Cat. K-3502
P&P $3.00

$29.75

FIND YOUR FORTUNE!
METAL DETECTORS



Cat. K-3100
P&P $3.00

An induction balance metal detector at a budget price. You build yourself and save/make a fortune!

$35.50

K-3504

Simple circuitry means simple operation. Designed by E.A. using digital integrated circuitry.

$19.50

P&P $2.00

PARTS FOR NEW KITS

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TLO 74 Quad Bifet Op Amp **Z-6034 $2.75**
CA 3080 Transconductance Amp **Z-6024 $2.45**
CA 3140 FET Op Amp **Z-5417 $1.48**
LM 380 Audio Amp. **Z-6080 $1.48**
LM 394 Super Watched Transistor Pair **Z-6083 $4.50**
LM 317 Adjustable Regulator (TO-220) **Z-6541 $1.95**
XR-2206 Functions Generator **Z-6820 $5.95**
MOC 3020 21 OPTO-ISO-TRIAC Z-4516 $2 75
4016 CMOS **Z-5616 49¢**
4029 CMOS **Z-5629 $1.65**
4069 CMOS **Z-5669 45¢**
40194 CMOS **Z-5694 $3.50**
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MM 5865N Universal Counter Chip **Z-6816 $9.75**
FNO 500Display **Z-4150 40¢**
Rectangular LEDs – RED **Z-4040 40¢**
GREEN **Z-4042 40¢**
YELLOW **Z-4044 40¢**

Printed Circuit Boards

Pavlovs Bagatelle **H-8411 $2.95** **E.A. August**
Super 80 Computer **H-8402 $97.50** **E.A. August**
Musicolor Chaser **H-8410 $9 95** **E.A. August**
Electrochune **H-8404 $11.50** **E.A. July**
Pools Lotto Selector **H-8403 $2.50** **E.A. July**
Audio Oscillator **H-8401 $3.95** **E.A. June**
Bench Mate **H-8400 $3.75** **E.A. June**
Noise Meter **H-8398 $2.35** **E.A. May**
Infra Red Remote Control **H-8397 $6.95** **E.A. May**
P.C. Birdies **H-8396 $2.25** **E.A. May**
Speed Sentry **H-8399 $1.95** **E.A. May**
Infra Red Beam Relay **H-8395 $3.95** **E.A. April**
Serial Interface **H-8394 $7.95** **E.A. April**
Cylon Voice **H-8387 $2.50** E.A. May
Universal Sound Synthesizer **H-8640 $2.50** **ETI August**
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Universal Relay Driver **H-8638 $2.25** **ETI May**
Humidity Sensor **H-8636 $2.25** **ETI May**
Core Balance Relay **H-8635 $4.50** **ETI May**
UHF to VHF Convertor **H-8637 $2.95** **ETI May**
Mosfet Amp **H-8633 $9.95** **ETI March**
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NEW KITS

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Cat. K-3143 P&P $4.00

$89.00

Includes our famous 'Sorry Dick It Doesn't Work' Guarantee

NOW AVAILABLE

THE FANTASTIC

SUPER 80

BUSINESS QUALITY KIT COMPUTER

Are you in the market for a fully functional computer for around half the price of competitive, built-up units??? If so — check out the fantastic features and price of the amazing Super 80 . . .

See our Ad on Page 73

Information & prices on these kits is based on magazine's advance information. Details, prices and availability subject to change — please phone your store before coming in.

UNIVERSAL SOUND SYNTHESIZER

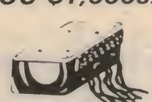
$17.50

This kit allows you to build ONE ONLY of the projects mentioned.

This kit consists of 5 projects based around a Texas Instrument IC. All dealing with sound effects! Projects include:
Bomb drop and explosion
Steam train and whistle
Phasor woop-woop alarm
Gunshot
All five projects use the same PCB and IC, with a handfull of passive components.

Cat. K-3508
P&P $3.00

THIS KIT COULD SAVE YOU $1,000s!



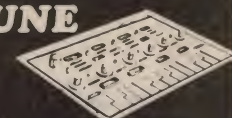
CAR ALARM

New improved design. Without false triggering problems. Simple installation. Protect your valuable property from would-be thieves!

$27.50

Cat. K-3253 P&P $3.00

ELECTROCHUNE Synthesizer



A versatile keyless monophonic organ that uses the circuitry of a synthesizer! It has variable attack/decay, tremolo, mixing control for an external input. Plus its own inbuilt amp and speaker with separate volume control. Touch sensitive keyboard. Ideal for experimenters!

$68

Cat. K-3506
P&P $4.00

HOT CANARY

An electronic bird whistle that sounds authentic. Keeps the kids amused for hours!

$14.95

Cat. K-3395
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UHF TV Downconverter

This single channel kit converts transmission from the UHF band down to the VHF band for normal TV reception

$32.50

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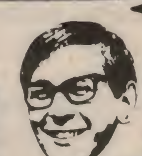
DICK SMITH Electronics

Mail Order Centre: P.O. Box 321 Nth Ryde NSW 2113 (02) 888 3200
145 Parramatta Rd **AUBURN** 648 0558; 613 Princes Hwy **BLAKEHURST** 546 7744; 818 George St **BROADWAY** 211 3777; 531 Pittwater Rd **BROOKVALE** 93 0441; 147 Hume Hwy **CHULLORA** 642 9822; 162 Pacific Hwy **GORE HILL** 439 5311; 30 Grose St **PARRAMATTA** 683 1133; 125 York St **SYDNEY** 290 3377; 173 Maitland Rd **NEWCASTLE** 61 1896; 263 Keira St **WOLLONGONG** 28 3800; 96 Gladstone St **FYSHWICK** 80 4944; 166 Logan Rd **BURANDA** 391 6233; 842 Gympie Rd **CHERMSIDE** 59 6255; 60 Wright St **ADELAIDE** 212 1962; 399 Lonsdale St **MELBOURNE** 67 9834; 656 Bridge Rd **RICHMOND** 428 1614; Cnr Dandenong & Springvale Rds **SPRINGVALE** 547 0522; Cnr Wharf St & Albany Hwy **CANNINGTON** 451 8666; 414 William St **PERTH** 328 6944.

VISA

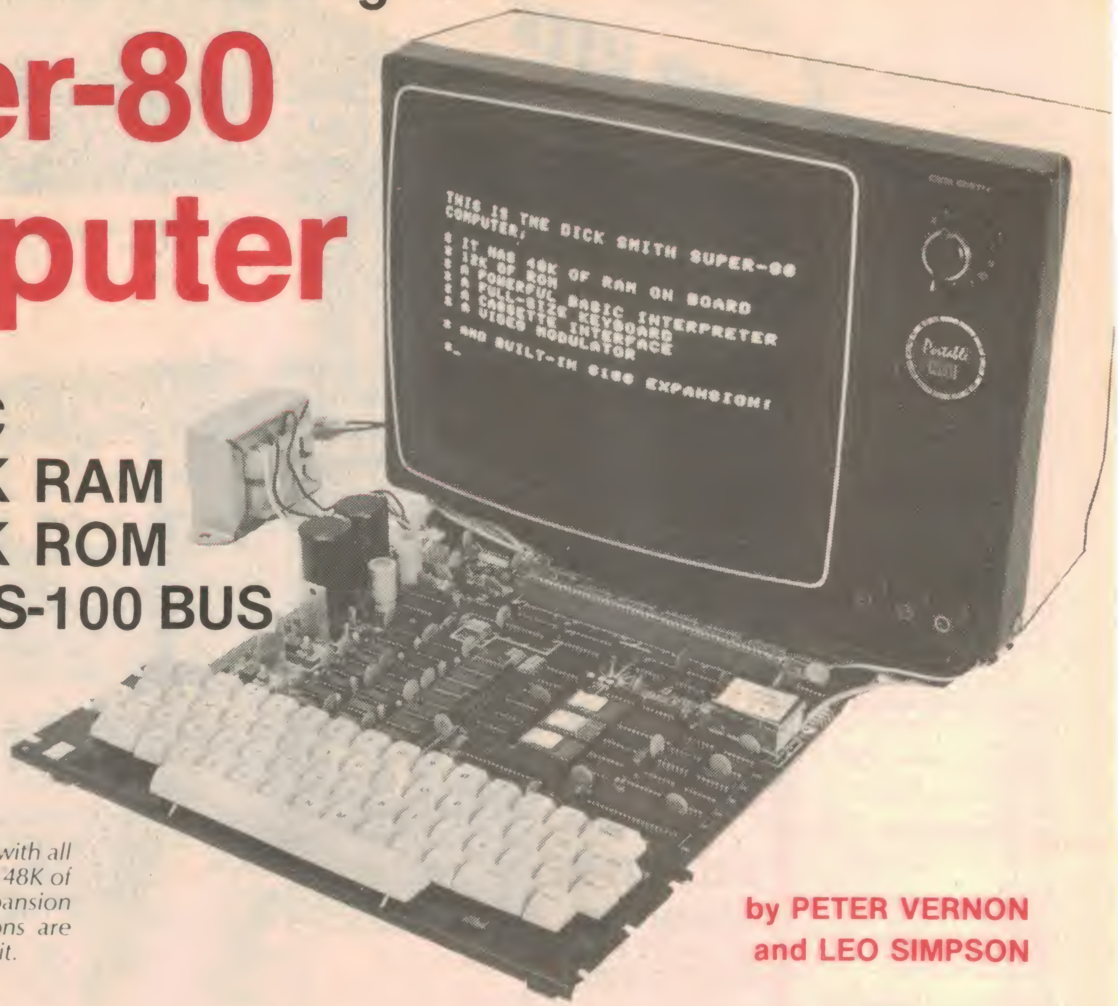


REMEMBER: They look so good your friends will never believe you built them!

What you've been waiting for!

Super-80 Computer

- * 9K BASIC
- * Up to 48K RAM
- * Up to 12K ROM
- * Optional S-100 BUS



This is the Super-80 Computer with all options on the board including 48K of RAM, 12K ROM and S100 expansion socket. Note that these options are not included in the standard kit.

by PETER VERNON and LEO SIMPSON

Finally, the Super-80 has arrived. Most of our readers have known that it was coming for ages. It was first advertised in the Dick Smith Electronics catalogue over a year ago. Now at last we can tell you what it's all about — it's features, ease of assembly and substantial cost advantage over built-up computers. It is probably the biggest and most complicated electronic device ever described in the pages of this magazine and, we venture to say, it will easily be the most popular computer project published in any magazine anywhere in the world!

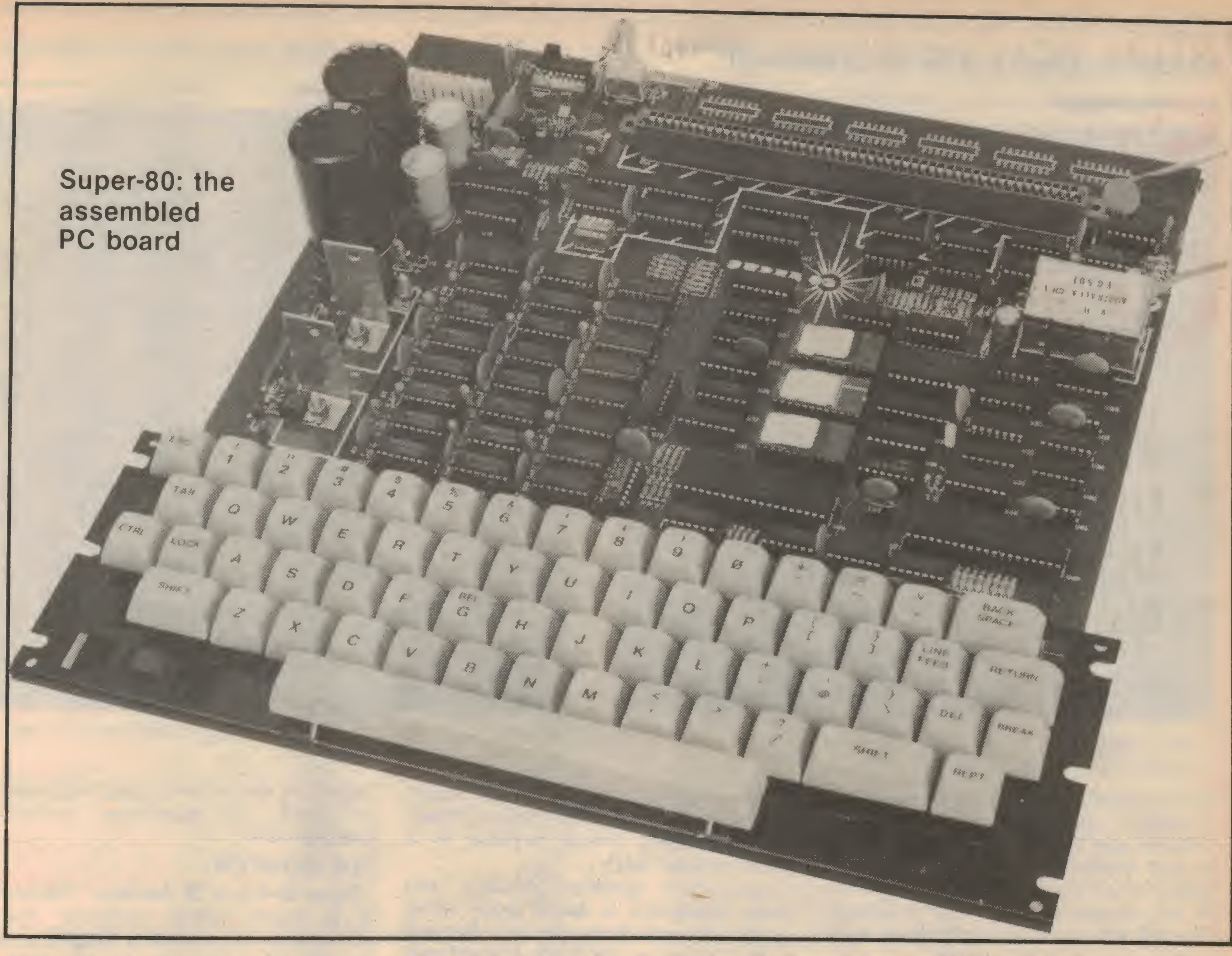
Let's face it, this project has been fraught with difficulties. Dick Smith and ourselves at "Electronics Australia" were very enthusiastic when this project was first mooted well over 18 months ago. But we and Dick just did not envisage all the difficulties and trouble involved in designing the hardware, writing the software, debugging the complicated double-sided PC board and so on. Even the name had to be changed from Nova-80 to Super-80 to avoid possible legal ramifications.

Fortunately, Dick Smith sponsored the project from start to finish, employing the services of a full-time designer and also devoting many hundreds of hours of his own employees' time in its development and final debugging. Fortunately, because "Electronics Australia" certainly could not afford all the man-hours devoted to this one large project. And fortunately, because without the persevering enthusiasm of Dick Smith and his staff, the Super-80 would not have finally seen the light of day.

While there have been other single-board computers in kit or assembled form and there are low-cost Basic computers, none can compare with the Super-80 in all-up features or in overall cost. The Super-80 has most of the desirable features of the Tandy TRS-80 and System-80 computers plus it has a few extra features of its own such as the optional on-board S-100 expansion socket and capacity for up to 48K of RAM.

Now let us describe some of the principal features. If you are ignorant of computers but nevertheless interested, now is your chance to get in on the ground floor. Come along for the ride. The Super-80 works with easy-to-use BASIC language but has a powerful Monitor for those keen on machine language programming. And just in case all the computer jargon damps your interest, we have made it as easy as we can by including a comprehensive glossary at the end of this article.

Super-80 is impressive to look at, in its unadorned state. It uses a beautifully laid-out double-sided PC board which is just over 300mm square. The topside is screen-printed with the component



This photo shows an assembled Super-80 prototype which includes components for the optional S-100 interface, a transformer connector, a DIP switch, and two additional EPROMs which will not be supplied in the basic kit.

overlay while the underside has a green solder mask which not only looks "suave" but will help prevent problems due to inadvertent solder bridges and splashes. Naturally, all component holes are plated through for continuity. The board is plated all over for corrosion resistance and ease of soldering, and generous lands are provided for enhanced heatsinking of the three-terminal regulators.

A full-size 60-key professional standard keyboard is used. It is equally as good as the keyboards used on any of the big five personal computers (Apple, Compucolor, Sorcerer, System-80 and TRS-80) and has equally good "tactile feedback". This latter piece of jargon means that the keys have positive travel so that your fingers "feel" that they really have pressed particular keys. This is in contrast to the keys on some economy systems which have limited key-travel or squashy membrane-type keys.

Another good feature of the keyboard is the fact that it has "double shot-moulded" keytops. This really obscure piece of jargon means that the keytops are moulded in two steps: first, the black letter-head and push-on base; then the beige keytop cover. The result of this process means that the letters will never rub off the keytops even if you have sandpaper finger tips.

Each key is held in a black metal matrix and the contacts are soldered directly on the PC board. If you desire to house the whole computer in a case with angled keyboard section, it is possible to cut off the keyboard section of the PC board to mount it separately at the required angle while connecting to the main computer section via a short length of ribbon cable.

CONNECTS TO ANY TV SET

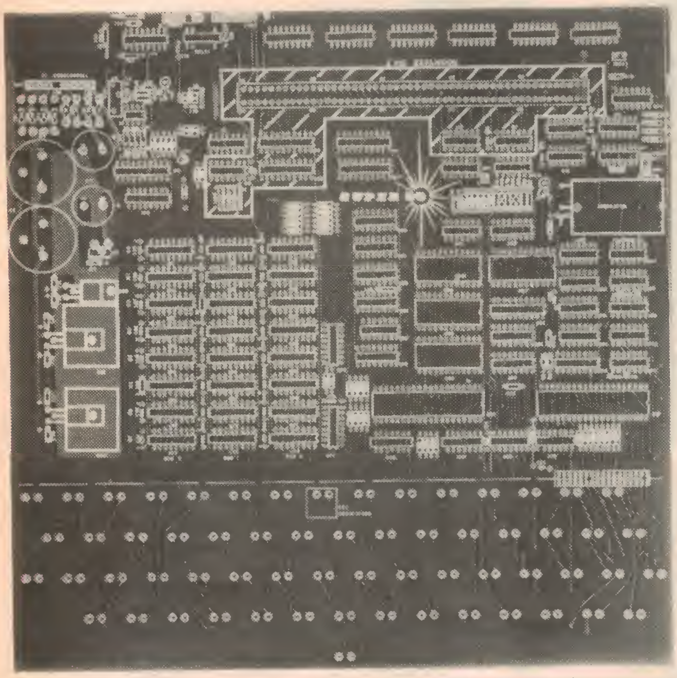
All the power supply circuitry is on the PC board. All that is required to power it up is a moderately sized transformer. Super-80 will interface to any standard television receiver via its VHF modulator which is set to Australian Channel One. Alternatively, for improved display definition, the PC board can be wired to provide a direct video signal to sets that have been suitably connected. We'll tell you about that later.

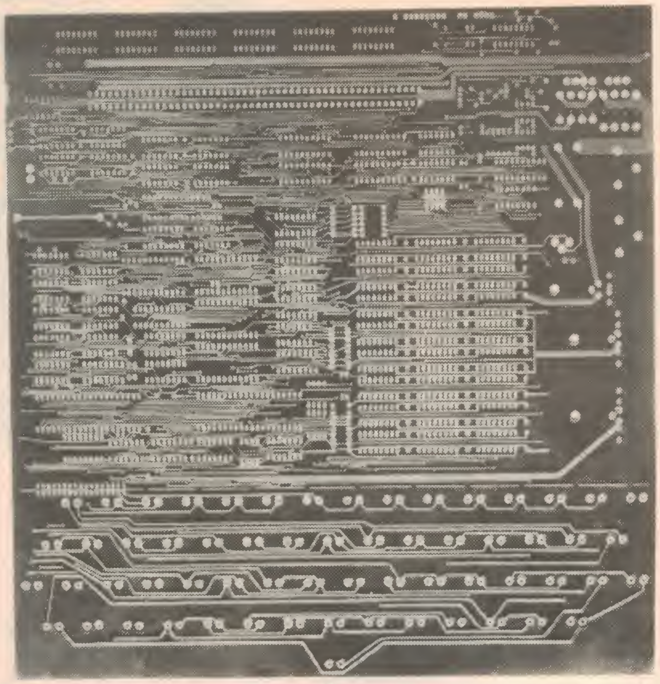
The Super-80 from Dick Smith Electronics is a complete computer in kit form, with a typewriter-style keyboard, video display circuitry and cassette interface all on a single printed circuit board. A Basic interpreter is available which allows programming with simple English commands. The Super-80 can be expanded into a powerful and sophisticated computer system, or used alone as a dedicated controller of other equipment. It has an optional S-100 bus facility and can be used with any TV set.

Note that since all the voltages on the PC board are low, it is quite safe to use it in the bare-bones state, as pictured here. We merely attached a number of adhesive rubber feet to the PC board to raise it off the bench surface.

CASSETTE INTERFACE

Programs can be stored on any standard cassette recorder via the tape inter-





Shown here are the topside (left) and underside of the Super-80 PC board. Note that the underside has a solder mask to avoid problems with solder bridges.

face which is designed to the Kansas City standard with signal frequencies of 2400Hz and 1200Hz. The tape interface is also needed to load the Basic interpreter which will be initially available only on cassette together with a manual. We will talk more about the Basic interpreter later on in this article.

During tape operations, the screen is blanked and a LED on the PC board indicates that loading or dumping is proceeding satisfactorily by flashing slowly. If the LED stops flashing, a read error has occurred. At the conclusion of tape operation, the video display is restored.

Programs can be loaded (into memory) or dumped (onto tape) at either of two speeds, 300 and 600 baud. At 600 baud, the 9K Basic interpreter will take about 2½ minutes to load.

Included in the cassette interface is a relay to control the motor in the tape deck. This means that the microprocessor can start and stop the tape transport, as is normal practice in systems such as the Tandy TRS-80 and the Dick Smith System-80 computers.

As might be guessed from the name "Super-80", this system uses the universally popular Zilog Z80 8-bit microprocessor chip which has an enormous amount of software written for it.

MEMORY

Random-access memory (RAM) for the Super-80 is provided in the form of the popular and inexpensive 4116 16K bit dynamic RAMs. "Dynamic" memories store data in the form of a charge on arrays of small capacitors rather than in arrays of transistors as used in "static" memories. This gives the dynamic memory the advantage of much lower power consumption and a much greater packing density (more memory in a given package size).

Comparison between dynamic and static memories is made even more graphic by considering the area devoted to the maximum 48K bytes of RAM provided for on the Super-80 board — just 24 16-pin chips. To obtain an equivalent static memory capacity would require 96 chips on a PC board of considerable size and drawing a current of several amps.

The disadvantage of dynamic memory is that the charges on the capacitor arrays tend to leak away and need to be periodically restored or "refreshed". The Z80 microprocessor is designed to provide this refresh cycle without being slowed down at all, so as far as the user is concerned, there is no practical disadvantage in dynamic memories.

Minimum RAM complement for the Super-80 is 16K bytes. That might seem like a lot compared with some of the more popular commercial personal computers which start with 4K. However, the 16K minimum for the Super is not an unmixed blessing when you consider that the Basic interpreter occupies a goodly part of that memory when loaded in from the cassette — all of 9K. Take away the memory needed by Super-80's Monitor for scratchpad and video display and the remainder is about 6K, which is still not to be sniffed at.

Memory expansion to a maximum of 48K is simply a matter of plugging in the necessary RAM chips and adding a single link to the board for each bank of eight chips. No other modifications are required, as the power supply is designed to feed the maximum memory complement.

THE MONITOR

Super-80 has a 2K Monitor. "Monitor" is a word which confuses many newcomers to computing. Does it mean the television set used for the display (video monitor), a special software album of all the standard routines used by the computer to make the system work, a school prefect or a three-metre long carnivorous lizard? You guessed it, the special software is the prosaic but correct answer.

The Monitor software manages the video display, cassette interface, keyboard scanning, provides facilities to alter and display memory, controls input and output ports and generally manages the execution of all programs with a variety of machine-language routines. In short, it drives everything. But if you work in Basic language you will largely ignore the Monitor.

Later in this series of articles, we will explain in detail about using the various features of the Monitor. This will be in addition to the handbook available for the Super-80 kit.

The Monitor is supplied with the Super-80 in a 2K 2716 or half a 4K 2532 EPROM. The Super-80 PC board can accommodate up to three 2532 EPROMs, making it possible to have the 2K Monitor and 9K Basic interpreter all in EPROM form, so that the system is ready to work in Basic at the moment of switch-on. In fact the Super-80 pictured in these pages was fitted with BASIC in EPROM form.

See article in this months E.A.
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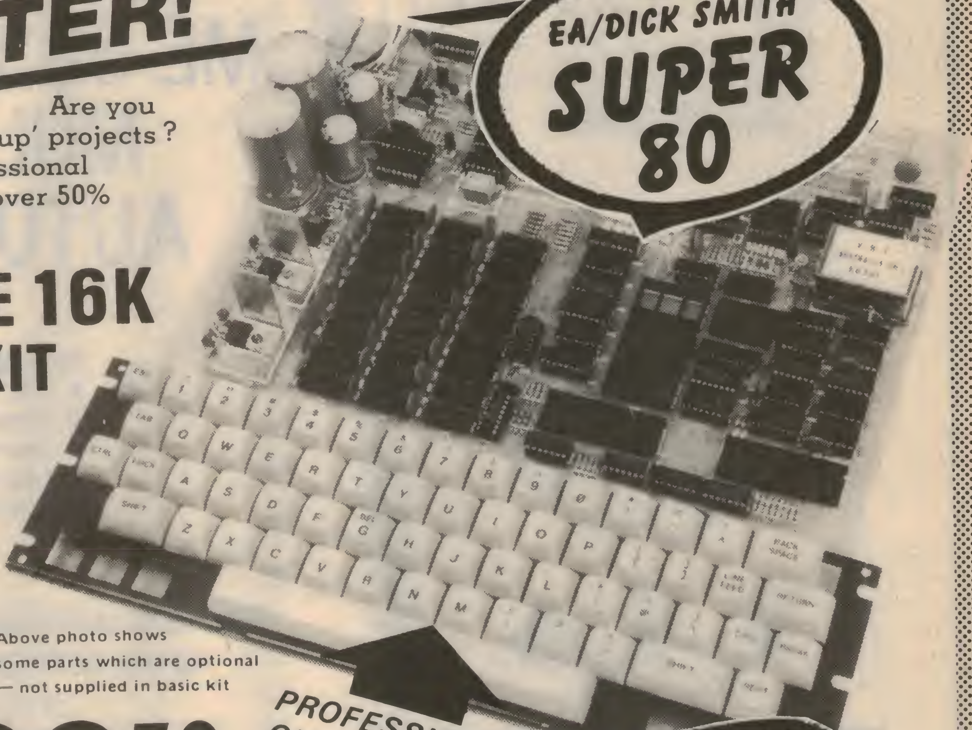

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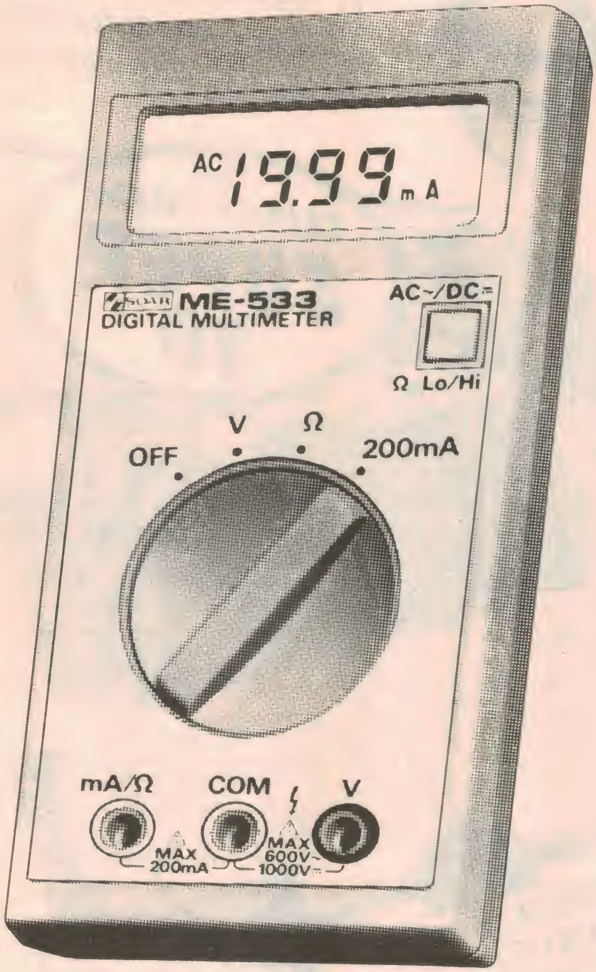

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BASIC

The 9K extended BASIC interpreter written for the Super-80 has facilities for handling string functions, integer and floating point arithmetic with accuracy from four to 14 significant figures, multi-dimensional arrays, and more. The manual available with the interpreter details these facilities fully, so we will not describe them here.

VIDEO DISPLAY FORMAT

A video display of 16 lines of 32 characters each is generated by circuitry on the board. Upper case only is provided, and there are no special graphics characters, but the video control circuitry has several interesting features which allow animated displays and games as well as providing basic output facilities for the system.

The video display is "memory mapped", which means that each character position on the display screen corresponds to a unique location in the system memory. Characters are placed on the screen by loading the appropriate memory location with the ASCII code for the desired character.

In a 16K system, the video controller circuitry can be instructed to display any one of a possible 32 pages of main memory, with each page containing 512 bytes. A number of pages can be held in memory at the same time and displayed in turn by an appropriate program, allowing very fast updates of the screen, as required for animated displays, for example.

The video circuitry operates by performing a Direct Memory Access (or DMA) on part of the main memory of the computer. This means that when the picture on the display screen requires refreshing, the video circuitry signals the microprocessor to give up its control of the system bus lines (the lines on which data, addresses and control signals are transferred between different parts of the system). In response to this signal the CPU completes its current instruction and sets the bus lines to a Tri-state or "floating" condition, allowing other units to use the bus without involving the central processor.

With the bus lines floating, the video controller circuitry accesses the system memory directly, reading the contents of part of the memory and displaying it on the television screen. On completion of the screen refresh the video circuit returns control of the system bus to the processor.

Video circuitry has been kept as simple as possible, and so contains no circuitry for producing a cursor (a mark on the video screen which indicates where the next character will be displayed), inverse video or graphics. Instead, a cursor is produced by software, by swapping two memory locations, to produce a flashing effect on the screen. The monitor program supplied with the Super-80 supports scrolling (moving the screen display up to fit a new line onto the

GLOSSARY:

ADDRESS: A binary number which uniquely defines a particular location in the computer's memory space. Since the Z80 has 16 address lines, there are 2^{16} possible combinations of ones and zeros which can make up an address, giving approximately 65,000 possible locations which can be addressed.

BASIC: A programming language consisting of a number of English-like program statements and commands and variables which may represent letters and numbers. A program in Basic is a list of statements which manipulate these variables. Each program statement is preceded by a line number and the computer, when given a "RUN" command, will go through the program, carrying out each statement from the lowest to the highest line number. By putting together statements in the proper order we can make the computer calculate income tax, keep accounts, remind us of important dates, work out maths problems or play Space Invaders.

BIT: An abbreviation of Binary Digit, the fundamental unit of information in the binary system.

BYTE: A group of binary digits, usually eight, which are operated on as one unit. There are 2^8 (256) possible combinations of eight bits from 0000 0000 to 1111 1111, which may represent letters, numbers, the position of a bank of switches etc.

BUFFER: Refers to an amplifier which is connected between two circuits to increase the current handling capacity of the output circuit.

BUS: The lines which provide communication paths among the various circuits which make up a computer system. The address bus transfers addresses between the units, the data bus transfers data, and the control bus transmits various control signals, which determine what is done with the data on the data bus.

CASSETTE INTERFACE: A circuit which converts the ones and zeroes of binary code into tones which can be recorded on audio cassette tape, allowing programs to be permanently stored in a convenient form. The interface also takes care of the reverse operation, "reading" the tape and converting the tones back into binary numbers which can be decoded by the computer.

CPU: Central Processing Unit — the circuit which does most of the work in a computer system. The CPU of the Super-80 is the Z80 microprocessor chip.

CLOCK: A pulse generator which provides timing signals to synchronise all operations within the computer system.

DATA: A byte or a number of bytes which are operated on by the computer.

DISABLE: The use of a control signal to halt the operation of a circuit or part of it.

DMA: Direct Memory Access — a method of transferring data between an external device and the computer's memory without involving the central processor in the operation. DMA is considerably faster than other techniques for data transfer to and from memory.

ENABLE: The use of a control signal to allow a circuit to operate, as in "enable the video circuit".

HARDWARE: In this context means the actual electronic circuitry and wiring of the computer. It can also mean the nuts and bolts that hold the board together.

INTERFACE: A circuit which transfers data between one device and another.

INTERPRETER: A special purpose computer program which converts a high level language such as Basic into the correct instruction codes for the microprocessor. Basic uses English-like commands and statements, while the microprocessor responds only to ones and zeros. An interpreter translates the Basic program into machine code.

INITIALISATION: The process of preparing a circuit for operation by clearing counters, setting starting values etc.

I/O: Input/Output facilities allow the computer to communicate with the outside world. An I/O Port is a data path to or from external devices. The PIO chip used in the Super-80 contains two parallel I/O ports which connect to the keyboard.

INSTRUCTION: At the time a microprocessor is designed various "instructions" are built into it. Each instruction is represented by one or more bytes, and sending these bytes to the microprocessor will cause it to carry out the instruction represented by those bytes.

(Continued on p77)

display), clearing the screen, cursor positioning and tab stops (which operate in a similar fashion to the tab stops of a typewriter).

Super-80 performs a screen refresh every 20 milliseconds and the process lasts for 10 milliseconds. Thus, for 50% of the time, the CPU is disconnected from the system. The processor can be made to run for 100% of the time by turning off the video display controller temporarily. Operations which require intensive processing can be speeded up in this way and made to run in half the time.

Timing for the Super-80 is derived from a 12MHz crystal oscillator. This basic frequency is divided down to provide the line and frame sync pulses for the video, the 2MHz clock for the Z80 processor, access control for the DMA screen-refresh operation and the frequencies for the cassette interface.

PRICE STRUCTURE

Because the Super-80 can be built in a number of forms, the price can vary according to what is required. In its most elementary form, the Super-80 can be purchased for just $289. This price

This is what the standard kit will look like when you unpack it. Not shown is the tape cassette with interpreter plus an instruction manual.

Continuing the Glossary

JUMP: Normally a microprocessor will carry out the instructions stored in memory, working from the lowest memory location to the highest. A Jump instruction causes the processor to execute a step out of the usual sequence. A power-on Jump causes the microprocessor to begin execution of instructions which are stored elsewhere in memory, rather than in the first locations.

K: An abbreviation for Kilo, but in this context we are working with a binary unit with a value of 2^{10}, or 1024, not a decimal thousand. This is the reason why 16K of memory actually contains 16,386 memory locations.

MACHINE CODE: The binary form of the instructions understood by the microprocessor.

MONITOR: This word is used in two senses. A video monitor is like a television without the tuner and television frequency detector circuits. It accepts a video signal which conrols the display on the screen.

A MONITOR PROGRAM is a special program which takes care of communication between the computer and the user. The Monitor program of the Super-80, for example, controls the keyboard and the video display and allows us to communicate with the computer.

PARALLEL: A method of transferring each of the bits making up a byte simultaneously over separate wires, with one wire for each bit.

PROGRAM: A sequence of instructions arranged to control the processor in carrying out a particular task.

RAM: Sometimes called "read/write" memory, because data can be stored in it and later recovered, or read, by the processor. This is the memory in which the user writes his or her programs. RAM is "volatile", which means that it loses its contents when the power to the system is turned off.

REGISTER: A memory location which is on the same chip as the microprocessor, and is used for temporary storage of data and instructions during processing. The most important register is the **ACCUMULATOR**, which holds the results of all operations performed by the processor.

ROM: This is an abbreviation for Read Only Memory. As the name implies, ROM cannot be written into, but can be read from. The advantage of ROM is that it is not volatile, and can be used to store programs which must be ready for use as soon as the machine is turned on. The monitor program of the Super-80 is stored in an **EPROM,** which is type of ROM which can be erased (by exposure to ultra-violet light) and then programmed by a special device. Once programmed it holds its contents indefinitely, even without power.

ROUTINE: A program or part of a program which is designed to carry out one specific function. A "cassette write routine" for example takes binary data from memory and translates it into serial form and then outputs it to the cassette interface.

SERIAL: A method of transferring data one bit at a time over a single wire. As long as the data is set with precise timing it can be recovered at the other end and assembled into parallel form again.

SOFTWARE: Refers to all programs and routines available for a certain computer or microprocessor. Software can be divided into two classes. Applications software is software usually written by the user which carries out a certain task or application. Systems software are programs in the computer which organise the computer's resources for a wide variety of applications. The monitor program of the Super-80 is an example of systems software.

SYNC: Describes the pulse trains which synchronise the line scan and frame rate of a television or video monitor. The line scan occurs at a frequency of 15625Hz and the frame rate (vertical sync) occurs at a frequency of 50Hz.

WRITE: To transfer information to a device.

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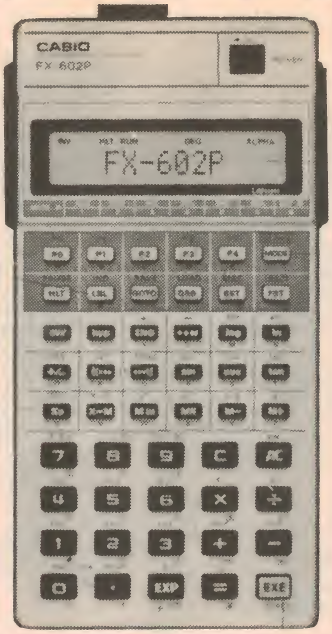

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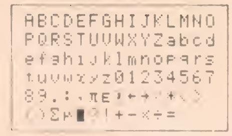

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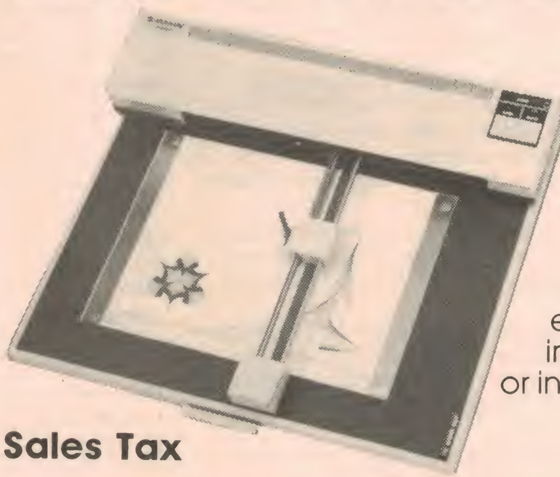

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includes the Super-80 2K monitor in a 2716 EPROM and 16K of RAM, keyboard and all the other bits shown in the photographs accompanying this article. A transformer to suit the kit adds $22.50.

A complete set of IC sockets for a 16K version costs $12.50. We would strongly recommend that you consider this option. Further, we would suggest that you purchase enough sockets for all 48K of RAM, 12K of ROM and perhaps even the optional S-100 bus interface. This will make subsequent upgrading simply a matter of plugging in ICs and bunging in a few links. You could even eliminate the need for links by buying a couple of four-way DIP switches. Perhaps Dick Smith will provide these as a further option.

Perhaps the biggest feature of the whole Super-80 is the provision of a "Sorry Dick, it doesn't work" coupon. If you wish to avail yourself of this service (assuming that the worst comes to pass and you really can't get it to work) it will cost you $100. This may seem like a steep charge but considering that it is a blanket charge which covers all eventualities — all parts and whatever labour is required to make the system fully operational — it is really quite reasonable.

There is one condition that you must satisfy if you subsequently wish to avail yourself of this service — you must use IC sockets throughout. Again, this is only practical and is a wise move anyhow.

Price of the 9K extended Basic interpreter on cassette plus manual is $24.50. So the minimum all-up cost for the Super-80 with 16K of RAM, Basic interpreter, IC sockets and transformer is $349. No other computer system on the market, either in kit or built-up form can match that!

PC BOARD

For those who wish to build their own version of the Super-80, Dick Smith Electronics will make the printed circuit board itself available separately. Price of the PC board will be $97.50 which may seem very steep at first but consider that it includes a high initial production cost, sales tax and profit margin plus a royalty to the designer.

Prices of the Basic interpreter in ROM form and additional RAM have yet to be settled at the time of writing this first article. But no matter how you look at it, the Super-80 must be a winner.

And just to help make sure that you are enthused, Dick Smith has arranged for a competition to be based on the Super-80. We will announce the full details of this competition and the prizes in due course.

Well that concludes our initial introduction of the Super-80. We hope that you will agree that it has not been too daunting. If you are reasonably familiar with electronics and have successfully built a number of projects of reasonable size from this or other magazines, you can confidently consider assembling your own Super-80 and thus learn about the attractions of computing. If you have little experience of building kits and making them run, we suggest you bide your time and gain some more experience before "having a go" at a project of this cost and complexity.

Next month we will publish the block diagram of the Super-80 and give a full description of the construction. Don't miss it. You will want the complete series for your future reference.

(To be continued)

While being presented in "Electronics Australia", this project was solely developed by Dick Smith Electronics. As such, "Electronics Australia" will not be in a position to offer detailed technical advice through our Information Service to readers who encounter technical difficulties.

The Serviceman

Is there a boom in exploding batteries?

In my June notes I told the story of an exploding maintenance-free car battery, and the trauma and inconvenience which it caused. I was unable, at that time, to offer a convincing explanation for the incident, but promised to follow up some leads in the hope of solving the mystery.

The June story revived a previous one (May 1979), and stirred up a number of new ones about the supposed tendency for these batteries to explode for no obvious reason. At the same time, a number of explanations were offered as to why it might happen.

Unfortunately, in spite of talking to a lot of people — victims, or friends of victims, and a couple of battery manufacturers — I am only a little wiser, and in some ways more confused, than I was before. At best, I can only put what appears to be two quite opposite sides of the story, while emphasising that there seems to be a serious lack of communication between the manufacturers, the dealers, and the customers.

On the one hand the battery manufacturers — and one large one in particular — have been able to clarify several points in the purely technical sense, and confirm my own theories on the maintenance-free battery concept. They also presented their side of the exploding battery problem. Considering the sensitive nature of the subject, they were more helpful than one might have expected.

On the other hand, the situation faced by the ordinary motorist, needing to buy a battery, is quite different. At best he seems to face conflicting statements and situations, misleading information, or no information at all.

He may well have heard stories about maintenance-free batteries being prone to explode — my own count is 10 cases so far, without trying very hard — but he will be lucky to find a salesman for these batteries, who, professedly, has ever heard of such a problem. Of course, if the salesman is selling an opposing type of battery, the stories may come thick and fast!

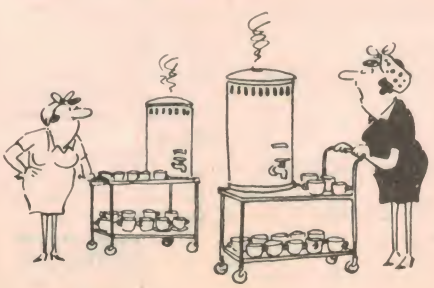
And if he does buy such a battery he will probably be told that he can fit it and forget it for the next four years; the guaranteed life of the battery. He will be told that there is no need to monitor the electrolyte level, and certainly no need to add water to it. Indeed, he won't even be shown how to add water, even if he wants to.

Yet there is plenty of evidence to show that the electrolyte level not only needs to be monitored, but may need to be topped up in some circumstances. What is more, this is not only possible, it is, if anything, easier to do than in the case of a conventional battery.

There also appears to be a "She'll be right, mate" attitude towards fitting the battery. In many cases the nearest physical size available does not fit snugly in the tray, or is not held securely by the clamps. The general attitude is, "Stick a bit of wood under it; she'll be right". In fact, there are plenty of reasons why such a slip-shod approach may be anything but right.

This appears to be particularly so in the case of some modern translucent cases which may not take as kindly to vibration and flexing as did the old hard rubber cases.

Nor does there seem to be much effort to check whether the car's electrical system is correctly adjusted. Some make a token gesture; most seem to ignore the requirement, and even poo-poo the idea that it may be desirable.



"Mine's doing about 45 to the gallon!" (From "Rolls Royce News")

From most of the following technical background, and useful general comment, I am indebted to Mr W. I. Allen, Technical Manager of Besco Batteries, Villawood, NSW. At the time of writing, Besco Batteries appear to be the only Australian manufacturer producing maintenance-free batteries in commercial quantities, although several other companies have products in the pipeline.

Mr Allen confirmed that it is the antimony, added to the grid material in conventional batteries to provide rigidity, which is the villain of the piece. It is the major cause of excessive gas production and loss of water during charging.

Fortunately, there are now several substitutes for antimony; selenium, sulphur, and cadmium have all been used successfully. With the generation of gas reduced to a minimum, water loss is proportionally reduced.

NOT REALLY SEALED

These batteries are not completely sealed, as is sometimes stated.

Use of a special grid alloy, plus the use of rather more electrolyte than in the past, results in a battery which should, under normal operating conditions, not need the addition of water during its lifetime. But — and this is most important — this assumes that the battery is used with a correctly adjusted voltage regulator electrical system.

In one sense correct adjustment of the electrical system is more important when used with a maintenance-free battery; in another sense it is less critical. It is important because any battery charged at a higher than optimum rate will gas excessively and lose water — maintenance-free type or not.

On the other hand the voltage at which the maintenance-free battery begins charging excessively is significantly higher than that for a conventional battery. Thus, an electrical system which is set marginally high for a conventional battery could still be within tolerance for a maintenance-free type.

But if the charging rate is excessive for a maintenance-free battery, it will create all the problems experienced with a con-

ventional battery – plus a few more. For example, loss of water in a maintenance-free battery can create one of two awkward situations; (1) the user may be completely unaware of the loss, being lulled into a false sense of security by the maintenance-free concept; or (2) if the loss is noticed, he is unlikely to know what to do about it. As already mentioned, the battery is easy enough to open, but customers are seldom instructed on how to do this.

One important point about the maintenance-free battery which Mr Allen was quick to emphasise is that it is basically a more efficient battery, using the word in its true engineering sense. Because the generation of waste gas is minimised, less energy is required to charge it than is required for a conventional battery. Fully charged, on float in the car, it should be drawing only milliamps of current; as low as 50mA under ideal conditions.

A pair of typical inter-cell connecting pads. The left-hand portion passes through the cell wall, the two are clamped under pressure and then welded together.

In fact, he tends to deplore that fact that the only advantage of this battery which appears to have been publicised is the maintenance-free concept. While a useful bonus, he puts it second to the improved efficiency.

All of which is very interesting background, but does little to solve the explosion mystery. One of the victims of these explosions was a large semi-government organisation with a large fleet of vehicles. Unfortunately, I did not get the story first hand, but it apparently surfaced shortly after my story of May 1979 and was supposedly inspired by it.

It was to the effect that some half dozen maintenance-free batteries had exploded, for no obvious reason, in vehicles shortly after a large number had been fitted with them. And, according to the chief maintenance officer, the explanation offered – though from what source is not known – was that it was due to a failure of the intercell link.

Whereas the old fashion battery was fitted with intercell links outside the battery, on top of the case, modern batteries use an internal link. This is supposed to offer a number of advantages, including a smaller battery and less resistance between cells.

But, it is stated, if this internal link should fail for any reason, creating an intermittent contact, or a path so fragile that it melts under heavy (starter) load, then a spark can be created within the battery, and most likely in a hydrogen/oxygen atmosphere. Naturally, such a failure in an external link would be far less likely to create an explosion.

It was also claimed that the main cause of the failure at this point was the method of making the intercell connection. Supposedly, the connection was only crimped, not welded, but I have to state right here that this claim has been totally discounted by the battery manufacturers.

They are adamant that these connections are always welded, although different manufacturers prefer different welding methods. Some use electric welding, some use gas flame, and, in a few cases, RF heating is used.

MISTAKEN IDEA

It appears that the crimping idea arose from a companion operation to the actual welding. The link between cells is made by welding together two mating lugs, through a hole in the cell partition. One lug is slightly recessed, and the other has a button-like protrusion, about 10mm in diameter and 2mm thick, which fits through the partition hole and mates with the recessed lug.

The two lugs are then electrically welded together, under pressure. This link is below electrolyte level, and the pressure expands the lead within the partition hole to make an effective seal. (This seal is subsequently tested under air pressure.) The welding and pressure process is automatic and the machine also monitors the welding current. If out of tolerance it – literally – pushes the battery off the production line. (The intercell links are tested twice more before the battery is passed.)

This should set the record straight in regard to one probable cause of an intercell failure, but it does not rule out such a failure for other reasons. In fact, the battery manufacturers freely admit that a small percentage of battery explosions have occurred due to internal failures of one kind or another.

But this theory poses nearly as many questions as it is supposed to answer. An obvious one is why this failure mechanism should occur only in maintenance-free batteries, since almost all batteries are now made in this way? And another obvious one is how a spark at this point can cause an explosion if it is below electrolyte level?

According to Mr Allen, the idea that such failures occur only in maintenance-free batteries is a fallacy. In fact, their records show that, of those batteries which apparently exploded due to internal failure, the proportion is slightly higher for conventional types than it is for the maintenance-free types.

Incidentally, Besco's records carry some other interesting figures. Of all the battery explosions they have investigated, covering all battery brands,

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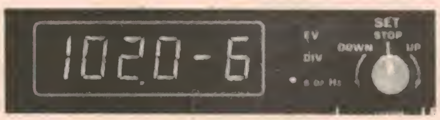
Microprocessor control also



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80% are due to external and, with hindsight, fairly obvious causes such as careless handling of jumper leads, charger leads, naked flames etc. Of the remaining 20% only about 5% can be positively identified as being due to mechanical failure.

The industry as a whole feels that battery explosions in general are on the increase, mainly due to the increased use of jumper leads. The popularity of automatic transmissions, and the preclusion of push-start's for a dormant vehicle turned clip jumper leads into an everyday toolkit item — and therefore the accepted way of starting a stalled car.

In the environment of a still "gassing" battery, a spark from carelessly handled jumper leads may be all that is necessary to provide a first class boom.

And what of the second question; how can a spark at the intercell connection cause an explosion if it is below electrolyte level? The chances are that it will not; that is, if the electrolyte level has been maintained. But, as I have already pointed out, this level can drop and there is less chance of it being monitored in a maintenance-free battery than in a conventional type.

THE EARLIER STORY

And this brings us back to my story in the June notes, and a possible explanation for that incident. We know that the charging rate was "... a bit high", to quote the salesman who fitted the battery. So, over a period of 18 months, it is quite likely that the electrolyte had dropped below the intercell links, if not the top of the plates.

If, then, one of the intercell links developed a fault, there would be no protection in the event of a spark, and an explosion would be almost inevitable. I put this theory to Mr Allen who agreed that it was a perfectly tenable one — given the circumstances envisaged.

(I subsequently discussed the incident again with the victims, and learned one new interesting fact; the last couple of kilometres, from the main road to the beach, was only a rough bush track, one which pitched the car about quite violently. Could it be that this rough ride was the last straw that fractured an intercell connection?)

In summary, then, it appears that the idea that maintenance-free batteries tend to explode, more or less spontaneously, needs to be modified. Any modern battery, it seems, which uses internal intercell links, is a candidate for such an explosion.

Which is a pretty disconcerting conclusion; the more so because we tend to talk so matter-of-factly in terms of percentages of batteries which have exploded or which may explode in the future. The fact that so many tens of thousands of other batteries haven't exploded is cold comfort to the person whose battery does explode, particularly if he suffers physical injury as a result.

Surely the industry can do better than that.

To change the subject, here is another follow-up story, this time inspired by my story of the near fatal accident, related in the May issue. It comes from a reader, Mr D.R., of Leichhardt, NSW, and is best told in his own words.

Following your article in EA, May, 1981, consider the situation in which I found myself, in Brisbane some years ago. The situation: an old weatherboard house set into a slope. The underneath had been dug out and lined with "clinker" bricks — cheap, very porous, bricks made from the furnace ash and cement. In the house was an old "EKCO" B&W TV set, with an AC/DC chassis, connected via 300Ω ribbon to an antenna mounted on a galvanised iron roof.

It had been raining for a week and water was beginning to cover the concrete floor under the house, threatening to damage various things stored there. I was working away happily in bare feet and had to lean over to pick something up, so I reached out with my left hand to lean against the damp brick wall. The next thing I was picking up was myself out of the water!

I quickly grabbed the AVO and, after probing around the wall for a few minutes, finally realised that there was a 240V AC gradient down the damp wall. I had touched it at about the 140V point. Further "delicate" investigation showed that the metal capping strip on top of the brick wall was at full 240V AC.

It finally turned out that the capping was touching the down pipe, the down pipe was attached to the gutter, the gutter was touching the roof, the roof was connected to the antenna, and the antenna was connected to the TV set via the 300Ω ribbon. And, of course, the TV set was connected to the mains.

In addition, there were two other factors — (1) one of the capacitors in the TV set, in series with the antenna connection, was short circuit, and (2) the house wiring was incorrect, with the active line connected to the neutral pin, and thus to the chassis of the set.

In fact, the antenna and the metal parts of the building had been live for years, and could have caused a fatality at any time. It was just luck that the damp wall was acting as a potentiometer, with my hand as the wiper. Luckily I only touched it at the 140V point. Thank goodness that AC/DC sets are on the way out.

Well, that's Mr D.R.s story, and very concisely told it was too. It prompted the Editor-in-Chief, when he read it, to comment: "Had he reached a little further up the wall he would have been mortarfied". Ouch! (The Editor-in-Chief always did have a funny sense of humour.)

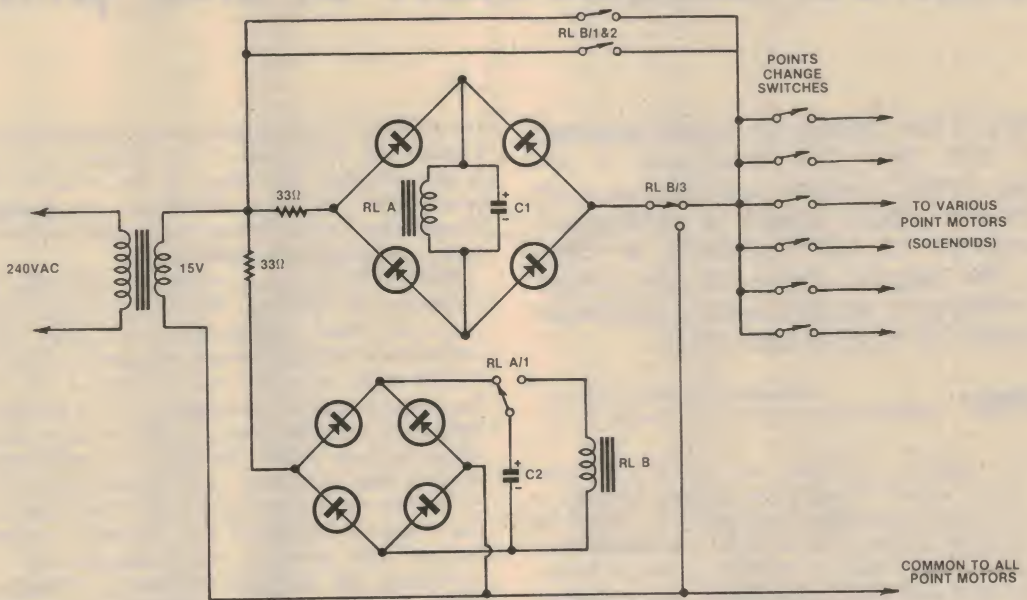
In fact, Mr D.R. goes on to describe some other potentially dangerous situations which can occur when mains voltages are applied to printed wiring boards. He cites one case where electrolyte from a leaky electrolytic capacitor had flowed across a board and, in effect, connected the mains active to the low voltage rail, causing enormous damage.

The truth is, I suppose, that we have never really learned to live with and respect the mains; every new application of mains power seems to bring a new set of problems, which have to be learned about the hard way.

Circuit & Design Ideas

Interesting circuit ideas from readers and technical literature. While this material has been checked as far as possible for feasibility, the circuits have not been built and tested by us. As a consequence, we cannot accept responsibility, enter into correspondence or provide constructional details.

Model Train Points Changer



C1 C2 330uF/35VW
DIODES = 1 AMP SILICON. PIV = 50V
RELAYS A&B – 12V WITH SUITABLE CONTACTS

In all but the simplest model train layouts, points are inserted into the tracks so that trains can be "switched" from one track to another. These can be remote controlled by applying a pulse of approximately 15 volts AC to the points "motors" (solenoids incorporated in the points). For this purpose, proprietary momentary-contact switches are available; but young children sometimes hold the switches "on" for long periods, resulting in expensive burn-outs of points solenoids and/or switch contacts – since the solenoids often draw several amperes of current.

To overcome this problem a pulsed burst of AC is required. Whilst an active electronic circuit could be utilised, many enthusiasts may have components lying in their junk boxes which could be used to fabricate a simple relay-operated timing device. Two 12-volt relays, a couple of electrolytic capacitors and eight 7 cent rectifier diodes are about all that is required.

Referring to the circuit it will be seen that when any one of the points switches is activated, a circuit through the "upper" diode bridge is completed via the solenoid winding; and energises relay A. Meanwhile capacitor C2 is standing by in a "charged" state, such that when relay A contact connects C2 to relay B, it pulls-in and applies 15 volts AC to the appropriate solenoid.

To hold relay A energised (and thus prevent relay B from dropping out during the timed period), contact 3 of relay B returns the "upper" bridge directly to the transformer secondary. The size of capacitor C2 determines the period that relay B remains energised, and was selected to provide approximately 0.5 seconds to ensure reliable points changeover.

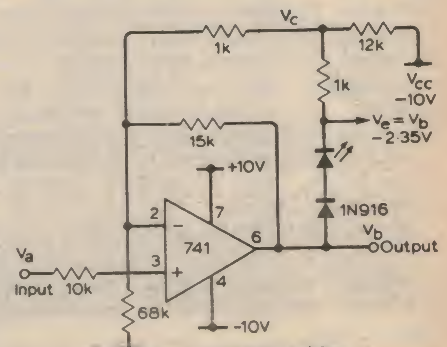
The points solenoid cannot operate again until the switch is released, allowing relay A to drop out, and thus recharge capacitor C2 ready for another operation. Apart from C2 the values of the other components are not critical – the 33Ω resistors merely serving to limit current through the relays. Any spare contacts on relay B should be paralleled to assist load sharing of the large current drawn by the points solenoids. Alternatively one heavy-duty contact could suffice.

W. Pearce,
Croydon, NSW.

Linear Led Control

Using only one op amp, the accompanying circuit is claimed to provide linear control of LED intensity. Maximum light output is achieved with +5.6V input; at −6.2V the LED extinguishes.

from "Wireless World",
January, 1981.



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Place a dab of clear lacquer on the top of integrated circuits and transistors to protect the labelling from rubbing off.

A. Williams,
Pomonal, Vic.

Vented Speaker

1: Detailed discussion of the principles

This is the first of two articles on vented speaker systems. In this part the emphasis is on understanding vented system operation and on identifying factors which ensure a satisfactory acoustic response of such systems at bass frequencies. The second article will give simple procedures whereby a suitable vented enclosure may be designed for a given bass driver.

BRIAN DAVIES* **Reader in Theoretical Physics, Australian National University, Canberra, ACT.*

Vented speaker systems, designed to extend the bass response of a given woofer, have been around for half a century. The first patent application was made by Thuras in the US in 1930 but for the first 30 years or so the subject was shrouded in mystery. There was no satisfactory theory which would enable the synthesis of a suitable design, just a number of recipes which were not always in agreement with each other. In some quarters the vented system came to be called the "boom box" and this description was certainly appropriate to a system which I remember listening to in the 1950s.

During the 1950s, a number of papers were written which together constituted the genesis of a theory. The crucial step taken in these papers was to represent the acoustical behaviour in terms of equivalent electrical networks to which conventional circuit analysis could be applied. The big leap forward was achieved by A. N. Thiele in 1961 when he used a simplified model for which an exhaustive mathematical analysis was possible. Having analysed the model, Thiele then went on to identify a wide range of possible combinations of woofer and enclosure which would lead to acceptable results. He also showed how the system parameters could be determined through measurements of the voice-coil impedance, making it relatively easy to implement the theories without recourse to an expensive acoustic laboratory. A number of papers have been written since then, notably by R. H. Small and P. J. Snyder. With the exception of the latter, all of the various authors have used complicated mathematics which is appropriate for only professional engineers. As a result, their conclusions have remained inaccessible to a larger audience. The purpose of these articles is not so much to add to what has already been written in other places, but to explain existing theories to non-professional readers.

The method of this first article is to work from the simple to the complex. For this reason only "ideal" systems are discussed in this part, because they exhibit all of the features which are necessary for an understanding of how vented systems work.

Woofer characteristics

To understand the behaviour of an isolated speaker at low frequencies, it is useful to regard the cone and voice coil assembly as a rigid piston which is suspended from the frame by a spring. The springiness is provided by the spider which centres the voice coil in the magnet and by the surround which attaches the edge of the cone to the frame. The assumption of rigid behaviour is generally good for frequencies below 200Hz or so, which is the interesting area when analysing bass performance.

When a mass is suspended by a spring, it has a natural frequency of vibration. This may be observed by giving the mass an initial displacement and then releasing it. The importance of this resonant frequency in the present context is that it is relatively easy to make the mass vibrate at frequencies near its resonance. For a speaker, the resonant frequency is determined by the balance between the total vibrating mass which includes a contribution from the air moving near the cone, and the stiffness of the suspension. From this, we can proceed to the following conclusions: (i) if the mass is increased the resonant frequency decreases because the system is more sluggish. (ii) if the stiffness is increased, the resonant frequency increases as a converse effect. Thus the resonant frequency is a measure of the ratio of stiffness to mass.

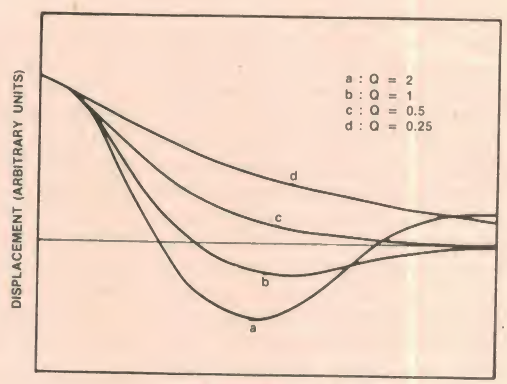
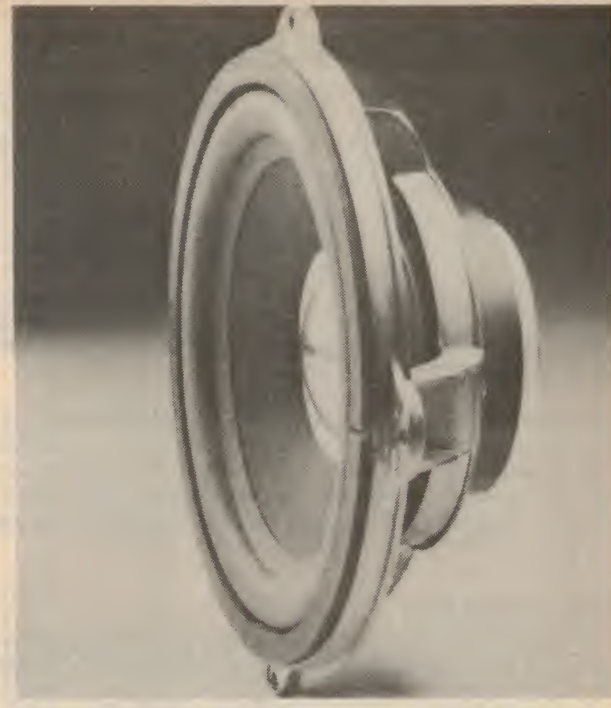


Fig. 1

Suppose that we now connect the woofer to an amplifier, which is turned on but to which no input is connected. If the cone is displaced from its normal position and then released, its subsequent vibrations will be damped, as shown in Fig. 1. The chief cause of the damping is electrical. As the voice coil moves in the magnetic field, it generates a voltage and this causes a current to flow with magnitude limited by the combined resistance of the voice coil, the connecting cables, and the amplifier internal resistance. (In this article, we shall assume that all resistances external to the voice coil are zero.) This current, because it flows in a magnetic field, exerts a force on the voice coil in a manner which damps the motion. The other important factors contributing to the damping are various frictional losses in the suspension. The effectiveness of the damping is specified by a number, Q. Small Q corresponds to heavy damping and large Q to little damping, again as shown in Fig. 1.

Systems of operation



8MV Mk 2 20cm high-power woofer from Magnavox. V_{AS} = 67 litres; f_s = 35Hz; and Q_T = 0.39.

The purpose of the cone is not just to vibrate, but to produce pressure variations in the air, which we regard as sound. Because the movement of the cone simultaneously produces low pressure on one side and high pressure on the other, an unmounted speaker is not able to radiate low frequencies effectively, due to pressure cancellation at the long wavelengths involved. Mounting it in an enclosure brings about a separation of the front and back waves, but it also changes the stiffness of the suspension.

Let us now imagine that the woofer is mounted in an infinite (ie, very large) box, often called an infinite baffle. We can then consider its behaviour when we apply a sine wave through the amplifier, varying the frequency but keeping the driving voltage constant. The displacement amplitude of the cone will be greatest for frequencies around the resonant frequency, falling off on either side at the eventual rate of 6dB per octave. Acoustic output is not equal to this amplitude, but to the product of amplitude with frequency. This corrects the 6dB per octave fall at frequencies above resonance, and turns the rate below resonance into a 12dB per octave slope. Thus the resonant frequency f_r is also a fundamental cut-off frequency. The response near resonance depends critically on the Q value, and this is shown in Fig. 2 where a number of curves are shown for different Q values. Two conventions have been adopted in drawing these curves; (i) the 0dB level is the high frequency limit. (ii) frequencies are not given in Hertz, but as a ratio with the resonance frequency (ie, f/f_r). Also shown in Fig. 2 is a dotted line representing the 12dB per octave bass roll off. For typical high quality woofers Q is in the range 0.25 to 0.4, so it is seen that the infinite baffle arrangement leads to a steady but inexorable roll off from well above the cut-off frequency. This trend is often seen in manufacturer's published response curves, which are for infinite baffle conditions. It is interesting also to reflect that the purpose of transmission line designs is to approximate infinite baffle conditions in a reasonable size of box!

Ideal sealed box

Suppose that we mount the speaker in a fully sealed box. This will prevent the back wave from escaping but it will also increase the resonant frequency. To understand the latter effect, remember that the vibrations of the cone will successively compress and rarify the air in the box. When the air is compressed its pressure is raised above normal atmospheric pressure, and the difference between the pressures acting on the front and back of the cone acts as an additional restoring force. In general the air in the box does not act as a perfect spring, rather it introduces some additional frictional forces which add to the damping. For the present I shall assume that these effects are negligible, and acknowledge this assumption by calling the box "ideal". Later, I shall drop this assumption. Note also that the box acts as a simple spring only if its dimensions are small compared with the wavelength of the sound: this is no problem as the velocity of sound is in excess of 300m/s, and our attention is confined to low frequencies.

The stiffness of the box depends on the ratio of the area of

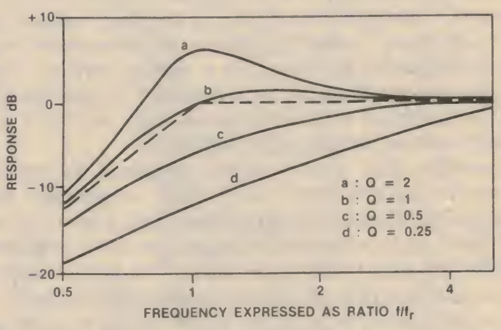


Fig. 2

the moving piston to the volume of the box: that is, it depends both on the woofer and on the box. An important parameter is the volume which the box must have so that its stiffness is the same as the woofer's original stiffness. This quantity is denoted by V_{AS}, and it is essential to know its value when designing speaker enclosures. Since the box stiffness is inversely proportional to the box volume, we may write the following relationship between the box stiffness k_B and the woofer stiffness k_S:

$$k_B = k_S V_{AS}/V_B \qquad (1)$$

For example, if the box has volume to one-third V_{AS}, the box will be three times as stiff as the woofer. The total stiffness is the sum of k_S and k_B, since both restoring forces act in concert. The effect of this on the resonant frequency is given by the formula

$$f_r = 2\pi\ (k/m)^{1/2} \qquad (2)$$

where m is the total vibrating mass. This shows that the resonant frequency increases in proportion to the square root of the stiffness. For a box of volume one-third V_{AS}, the total stiffness is increased by a factor four, and the resonant frequency is doubled. More generally, if we denote the resonant frequency of the woofer by f_S and the resonant frequency when it is mounted in a box by f_o, we have

$$f_o = f_S\ [(V_B+V_{AS})/V_B]^{1/2} \qquad (3)$$

In order to determine the acoustic output of the sealed enclosure we need to know the Q value of the woofer when it is in the box. Now the damping is caused by frictional forces and these are unaffected by the box. I have already stated that

the resonance f_S is related to the ratio of restoring force to mass, through equation (2). Similarly, to find the effect of the box on the Q value, we need to know that the quantity f_r/Q measures the ratio of frictional forces to mass, at the responant frequency. This is why small Q corresponds to high damping. What happens when we mount the woofer in an ideal box is that the ratio f_r/Q remains constant while f_r is increased. For this reason we must distinguish between the Q value of the woofer in isolation Q_T, and the Q value when it is in the box, Q_o. The relationship is

$$f_S/Q_T = f_o/Q_o \qquad (4)$$

which shows that Q_o is larger than Q_T by the factor f_o/f_S. In practice, when the chosen speaker enclosure is a sealed box the volume is chosen so that Q_o is close to unity. Since this usually means that the box is many times stiffer than the original suspension, this method of mounting is called acoustic suspension.

Ideal vented box

In designing an ideal sealed box for a given woofer, there is only one parameter which is at the disposal of the designer, namely the box volume V. By using a vent or port in the box, a second parameter is introduced. To see why, consider first the vented box with the speaker cut out temporarily blocked in. Such a system is known as a Helmholtz resonator, after the scientist who investigated it last century. For the purpose of designing the bass performance of a speaker system a simple model is adequate. In this model, the air in the vent acts like a mass and the air in the box like a spring: this is a resonant system characterised by two parameters, f_B and Q_B. For the present, I shall assume that the box is ideal, so that Q_B is very large and frictional forces f_B/Q_B negligible.

Now consider the vented system obtained by mounting a woofer in this vented box. The simple models for the two resonating systems may be combined into a new, composite model. This has two moving masses, the cone and the vent, each radiating sound as it vibrates. The cone assembly is subject to forces from four sources: (i) signals applied to the voice coil impress a force on the cone; (ii) the woofer suspension provides a restoring force, acting between the cone and the box itself; (iii) there are frictional forces characterised by Q_T; (iv) the air in the box provides a restoring force, only it no longer acts between the cone and a rigid box, but between the cone and the air in the vent. This latter force is the one and only force which is applied to the vent air mass, but it causes it to vibrate and radiate sound as well as the cone.

The effect of coupling the two resonant systems via the stiffness of the box is quite profound. The frequencies f_o and f_B are no longer resonances; rather there are two new resonant frequencies f_L and f_H. These frequencies may be calculated by solving the equations.

$$f_L f_H = f_S f_B \qquad (5)$$

$$f_L^2 + f_H^2 = f_o^2 + f_B^2 \qquad (6)$$

Formulas for the solution may be given, but they are not important for understanding the acoustic response. However, the reader may find it helpful to have one concrete example. For one system built by the author, the values were

$f_L = 21\text{Hz}$
$f_S = 35\text{Hz}$
$f_B = 36\text{Hz}$
$f_o = 52\text{Hz}$
$f_H = 59\text{Hz}$

To understand the role of these frequencies, it is helpful to think of a simpler coupled mechanical system which is easily visualised. Suppose we set up two identical pendulums, hung side by side from a horizontal support. Each is a mass m suspended by a light string of length ℓ. The two masses are connected by a spring, whose mass is negligible compared with m. With the connecting spring omitted it is possible to set the two pendulums oscillating in unison by starting them in identical manners. This must also be one of the two coupled modes of oscillation since it would have no effect on the length of the spring. The other mode has the two pendulums moving in opposition to each other, and since the spring is providing extra restoring forces in this case, its frequency must be the higher of the two. The general principle, which applies to less symmetrical systems such as the vented speaker is that, when two natural resonators are coupled, there are two coupled modes of vibration. One of them, the lower resonant frequency, minimises the effect of the coupling. The other, at the higher resonance, maximises it.

In the present context, the lower resonant frequency f_L minimises the effect of the coupling between cone and vent. In this mode, the cone moves out while the vent takes in air, and vice versa, rather like a pump with a hole in it, and so there is very little net acoustic output from this action. At the higher resonant frequency f_H the effect of the coupling is maximised because the cone and vent air move in and out together, radiating constructively. The actual level of output is governed by the damping at f_H, and here the effect of the coupling has a second profound effect. To see this, recall that before the coupling is introduced, only one of the two natural resonators (the woofer) had any damping. However, both of the coupled modes involve movement of the cone, and the frictional forces represented by f_S/Q_T have to be shared between the two. Thus the Q value of the upper resonance is greater than $f_H Q_T/f_S$, so that it is possible to achieve a damping factor of unity for this mode without making f_H/f_S as large as the corresponding ratio f_o/f_S for the sealed box.

This is not the end of the story. At the box resonant frequency f_B, which is well below f_H, the vent will give a large output without the cone making large excursions. The output level of the vent is completely under the control of the driver damping, even for an ideal box. Thus the vented system works by employing the vent as an auxiliary radiator below the frequency f_H. For this reason f_H is sometimes called the cross over frequency.

Optimally flat response

Since the ideal sealed box is less complicated than the ideal vented box, I will return to it briefly. Reference to Fig. 2 reveals that the response curves for $Q_o = 0.25$ and 0.5 show a steady fall in response with falling frequency, whereas those with $Q_o = 1.0$ and 2.0 have a peak. Regardless of the Q value, the system is second order – it falls off at 12dB per octave – and the main features of the response are obtained by drawing a straight line representing this 12dB rate. The details of the curve near to resonance are controlled by the Q value, and in this respect the value $Q_o = 0.707$ is important. It is the largest value that Q_o may have without causing a peak, and the corresponding response is known as optimally flat. The response function G(f) will be given in the next section. It is not a complicated formula, but there is one frequency where it is particularly simple, namely the resonant frequency f_o. Here the formula is

$$G(f_o) = Q_o \qquad (7)$$

This shows that the optimally flat system is down 3dB at the cut-off frequency.

For an ideal vented box the response formula is naturally more complicated. The vented system is fourth order and falls off at 24dB per octave. The crucial question is whether there is an acceptable response curve joining these two straight lines. For the analogous fourth order electrical network, it was known that it is possible to achieve an optimally flat response (no peaks −3dB at cut-off) before Thiele published his

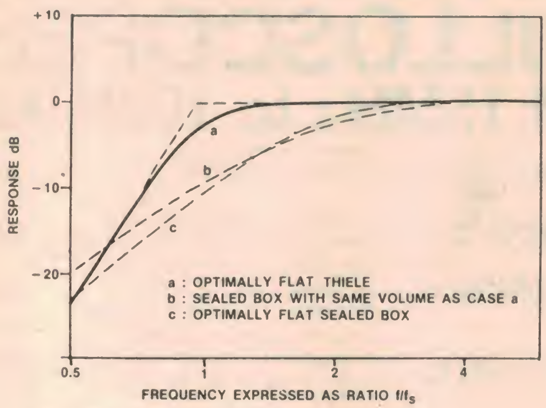


Fig. 3

important paper. Thiele found that there is a unique choice of parameters for the ideal vented speaker system which gives the optimal response. This is the now-famous Thiele optimally flat alignment and its response is shown as the solid curve in Fig. 3. The parameters for this alignment, including the cut-off frequency f_c, are

$$Q_T = 0.383$$
$$f_B = f_S$$
$$V_B = 0.707\ V_{AS}$$
$$f_c = f_S$$

Obviously this alignment is only possible if a woofer is available with the optimum Q_T value. Assuming that this is the case, it is interesting to compare the results of using the same woofer in a sealed box. First, if the volume of the box is given by the Thiele alignment, then the cut-off frequency is $f_o = 1.55\ f_S$ with a Q_o of 0.595; the low Q_o means that the response is −4.5dB at f_o. Choosing an optimally flat sealed system raises the cut-off frequency to 1.85 f_S. The response curves for these two choices are shown as dotted lines in Fig. 3. Note that the frequency scale uses f/f_S for all three curves, so as to enable direct comparison of results.

Response functions for ideal boxes

It is not the purpose of this article to delve into mathematical details. Nevertheless it is very useful to write down the formula for the response function and spend some time considering its interpretation. This will lead to an understanding of how the response depends on the choice of parameters V_B and f_B. In the second article this information will be turned round so that the parameters can be chosen to provide practical designs. The formulas take on their simplest appearance when we use the fundamental frequencies of the system as the basic units. That is, frequencies will not be absolute (in Hertz) but specified as the ratio of the cut-off frequency to other important frequencies such as f_S, f_o, f_B, f_L and f_H.

For a sealed box the cut-off frequency is simply the resonant frequency of the woofer in the box, f_o, for which a formula has already been given in equation (3). The response function is

$$G(f) = 1/[(1 - f_o^2/f^2)^2 + f_o^2/Q_o^2 f^2]^{1/2} \qquad (8)$$

The prominent feature of this formula is that it involves the sum of two squares. Since the square of a number can never be negative, the smallest value which either term may have is zero and in fact the first term is indeed zero at the resonant frequency f_o. Thus the importance of this frequency is apparent from a cursory inspection of the response function. Another way of viewing this is that, if the response function is derived in terms of the woofer parameters f_S, Q_T, V_{AS} and the box volume V_B, then we would immediately recover the formula for the resonant frequency f_o by observing that one of the terms becomes zero at this frequency. The other point which follows from equation (8) is that, when f is small, the response function is well approximated by the ratio f^2/f_o^2. This tells us that the system is second order and that f_o is the cut-off frequency.

For an ideal vented system (not necessarily the Thiele optimally flat alignment) the response function is given by the formula

$$R(f) = 1/\ [(1-f_L^2/f^2)^2(1-f_H^2/f^2)^2 + (f_S^2/Q_T^2 f^2)\ (1-f_B^2/f^2)^2]^{1/2} \qquad (9)$$

This is more complicated than the sealed box response but the interpretation of its major features is no more difficult.

The first point of interest is the cut-off frequency. This is found by observing that for small values of f the response is well approximated by the ratio $f^4/f_L^2 f_H^2 = f^4/f_S^2 f_B^2$. [The second form, with $f_L f_H$ replaced by $f_S f_B$ follows from equation (5).] This shows that the system is fourth order, and that the cut-off frequency is

$$f_c = (f_S f_B)^{1/2} \qquad (10)$$

The second point is that there are three frequencies where one of the two squares in the response function becomes zero, namely f_L, f_B and f_H. At these frequencies the response formula is simple in form and also of great interest.

Since the *raison d'etre* of the vent is to maintain response down to the box frequency f_B, even though the woofer itself has ceased to make a useful contribution, it is natural to calculate $R(f_B)$. Some simple algebra involving equations (3), (5) and (6) gives the result

$$G(f_B) = (f_B^2/f_S^2)(V_B/V_{AS}) \qquad (11)$$

In most practical vented designs f_B^2/f_S^2 is between one half and two; moreover we shall see that the choice of this ratio depends almost entirely the Q_T value of the driver. Consequently, this formula shows that once the woofer has been selected and f_B chosen, the response at f_B is determined by the size of the box. As an example, with the Thiele optimally flat alignment $f_B = f_S$ while $V = 0.707\ V_{AS}$, so that the response is 3dB down at the box frequency.

The other important frequency is the cross over, f_H. Again the response is easy to calculate, namely

$$G(f_H) = (Q_T f_H/f_S)[f_H^2/(f_H^2-f_B^2)] \qquad (12)$$

In the Thiele optimally flat alignment the response at f_H (= 1.76 f_S) is less than 0.1dB down. Generally speaking, vented systems are designed so that $G(f_H) = 1$. Equation (12) shows how the vent assists in achieving this objective. This is because the factor $Q_T f_H/f_S$, which is the damping predicted by the application of the principle that Q/f_r is a constant [see equation (4) and the discussion there] is multiplied by $f_H^2/(f_H^2-f_B^2)$ which is always greater than one. For the Thiele optimally flat alignment, the values are

$$Q_T f_H/f_S = 0.67$$

$$f_H^2/(f_H^2-f_S^2) = 1.48$$

This illustrates one of the profound effects of coupling the cone and vent. In this particular alignment, about two-thirds of the woofer damping is applied to the upper frequency resonance, with the other third applying to f_L. This enables the use of a larger box than the fully sealed design, which keeps down the various natural frequencies to a minimum.

Conclusion

This concludes the first article which was concerned with the principles whereby vented systems achieve their results. A number of questions arise, which must be answered in order to turn the principles into a set of design rules. They are:

(i) What effect does the box damping have on the response functions?

GLOSSARY

Quite a few terms are used in this article and some of these have not been defined. To help you keep track while reading the article, we have compiled this glossary:

f_B: resonant frequency of a vented box with woofer cutout sealed.
f_c: cut-off frequency; the −3dB point on the system frequency response curve beyond which the response usually falls at 12 or 24dB/octave.
f_H: upper resonant frequency of a vented speaker system. Also referred to as the mechanical crossover frequency.
f_L: lower resonant frequency of a vented speaker system.
f_o: resonant frequency of a woofer when mounted in a sealed box.
f_r: generalised term for resonant frequency.
f_s: resonant frequency of a woofer in free air.
k_B: stiffness of air in a sealed box when acted upon by a woofer.
k_s: stiffness of a woofer suspension.
m : total vibrating mass of a system.
Q: figure of merit for a resonant system. A high-Q figure refers to an undamped system while a low-Q refers to a heavily damped system.
Q_B: Q of a vented box resonance with woofer cutout sealed.
Q_o: Q of woofer resonance when mounted in a box.
Q_T: Q of woofer resonance when in free air.
V_{AS}: equivalent volume; the volume of air that offers a compliance to the woofer that is equal to the compliance of the woofer's suspension.
V_B: Volume of air in box.

(ii) How can equations (11) and (12) be turned around so as to tell us the appropriate values of f_B and V_B for a given woofer?
(iii) How can the parameters f_S, Q_T and V_{AS} be measured for a woofer if they are not specified in the manufacturer's literature?
(iv) How do we choose the dimensions of the vent?
(v) Having built a prototype, how can we check that its critical frequencies accord with the theory, and if necessary adjust the vent?
All of these questions will be addressed, and answered, in the second article.

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Letters to the editor

Sources for Peerless loudspeaker kits

The closing paragraph in your article on the Peerless PAS100 Loudspeaker Kits may be misconstrued to imply a very limited distribution for Peerless loudspeaker kits. A list of our current dealers is given below. Trade enquiries or further information on country dealers should be directed to GRD Group Pty Ltd 698 Burke Road, Camberwell 3124. Phone 82 1256.

We would appreciate it if you could publish this list to clarify the situation to your readers.

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Electronic knotmeters made by AWA

Referring to a letter to the Editor in your October issue concerning an electromagnetic knotmeter, we advise that AWA are suppliers of a number of electromagnetic type knotmeters/logs.

The principle of operation is not clever at all. It is indeed a very simple extension of dear old Fleming's right-hand rule where a conductor moving in a magnetic field has an EMF induced in it proportional to the velocity. An electromagnet located under the hull of the vessel generates a magnetic field around the hull in the water. When the vessel moves, an electromagnetic force proportional to the water (conductor) velocity relative to the field is generated. This electromotive force is collected by two metalic poles and converted into speed and distance information.

The main advantage of electromagnetic speed and log instruments is that the probe may be mounted flush with the hull of the vessel, thus creating a minimum of drag. EM probes are also less susceptible to damage through coming in contact with underwater obstructions. Two examples of electromagnetic logs are the Seafarer log designed specifically for small vessels and the Ben electromagnetic log designed for fishing and general purpose vessels.

G. R. Owen, Group Marketing Manager,
Marine and Aviation Divisions,
Amalgamated Wireless (Australasia) Ltd,
Leichhardt, NSW.

Negative ions and dust precipitators

For selfish reasons I have been following the articles on air ionisers. At the moment we seem to be at a similar state to the time when Edison had to post notices in electrically lit hotel bedrooms assuring hotel guests that the white-hot "hairpins in bottles" would not harm people who were accustomed to gas lights.

Forum May 1981 suggests to me one effect of the machines is to precipitate dust particles. Enclosed are some leaflets setting out some aspects of these "dust" particles — the particles are not necessarily of mineral origin.

A survey earlier this year indicated the range of incidence of asthma among school children was between 15% and 30% — the "asthma" varying from mild wheezing to incapacitating breathlessness.

I would suggest that far more than 30% of our population suffers other consequences of the air pollution generated and tolerated by our society. Most people dislike breathing air carrying irritating particles. My own nose suffers from chronic rhinitis, that is, the various internal surfaces of the upper respiratory tract, especially the sinus cavities, exude mucus to attempt to sweep away the offending particles.

One of the accompanying leaflets suggests tobacco smoke can be present at 2500 million particles per cubic millimetre or something like 5×10^{15} particles per average breath. (Most breathing is in the range of half a litre to one and a half litres of air for adults.)

Whatever their sources, the particles likely to cause rhinitis, asthma, or whatever cannot be caught by mechanical filters. Hence my interest in electrostatic precipitators.

To put it briefly, I don't care if the machine is called an ioniser or Strezleki indeterminate randomly positioned reference point distributor; if it precipitates dust. I would like to know more about it.

Over the years, I have gained the impression that your reputation as a scientific journal has been built on the integrity of your articles, and the dependability of the projects presented to the readers.

A. N. Brooks,
North Mackay, Qld.

COMMENT: Without claiming any expertise whatever in the matter of air ionisers, our impression is that you may well be the kind of person who might benefit, if only because of precipitation of particles in room air. But note what we have said about ozone, lest you merely exchange one irritant for another.

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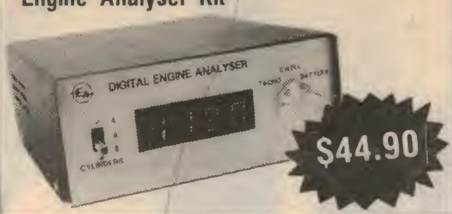

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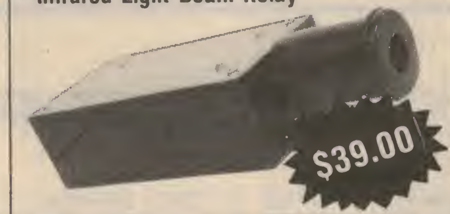

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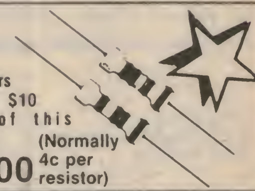

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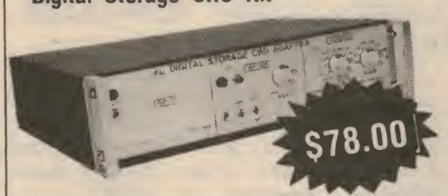

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AMATEUR RADIO

by Pierce Healy, VK2APQ

QSL — I am acknowledging reception

A universally accepted custom following an on-air contact between amateur operators is the exchange of their station identification cards. This month's notes discuss a number of other facets of QSL cards, including their place in amateur history.

Actually "QSL" is only one of several hundred abbreviations in the "Q" code formulated to enable telegraphists to bridge language barriers. Knowledge of "Q" code abbreviations applicable to amateur radio is part of the Regulations Section of the amateur licence examination.

The custom of exchanging cards, referred to as "QSL" cards, is one of the many facets of amateur radio that has been practised since the first two-way radio contact was made.

This form of verification has been the accepted evidence that a contact was actually made and is the proof required when applying for an award. Such awards are sponsored by national amateur societies, radio clubs, and the like.

All major awards require that an applicant holds "QSL" cards to verify contacts made in accordance with the rules of an award.

On the other hand, cards are often used to impress friends with one's ability to contact distant climes, to boast to fellow amateurs about a contact with an elusive station or country, or as a decorative wall display around the station and a reminder of exciting and interesting events and personal memories.

Apart from their use for gaining awards or just evidence of a contact made, some such cards are an historical record as to when radio contact was first made between countries or areas or as evidence of experiments by amateurs that proved that various frequencies could successfully be used for long distance or point to point communication.

There is another aspect of QSL cards worth noting. Because information on the card gives country of origin, (the first part of the station call sign) many older cards may be from countries that no longer exist in name or particular national alliance. Also many callsign prefixes are no longer in use today. Thus QSL cards often are mute evidence of the changing world scene.

As the "Q" code abbreviations were initially formulated for telegraphy, an opinion is expressed in some quarters that such abbreviations should not be used in telephony, the reason being that normal conversation should not require such abbreviations. But habits die hard and internationally known abbreviations often help bridge the language barrier, in telephony as they were designed to do in telegraphy.

The practice of "QSL-ing" is not obligatory; many operators nowadays have no interest in the exchange of cards. Others reply only to those from whom a card is received, others send a card for every contact made.

Design and layout vary according to the whim of the operator, but all give at least the basic information relating to date, time, and mode used, along with station call sign and location.

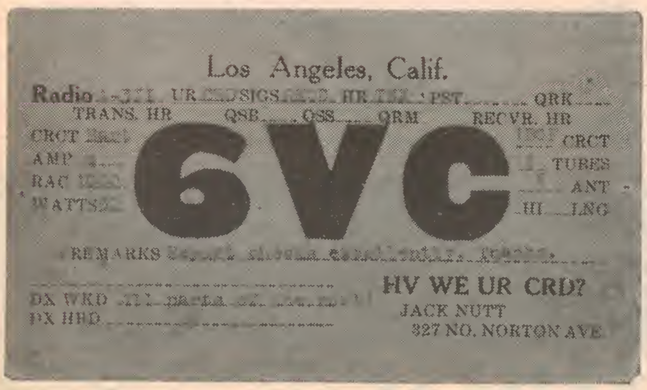
QSL cards, confirming contacts, have long been recognised as being the result of personal effort. However, this is now being questioned because of practice that has recently been adopted in relation to some rarer stations and call areas.

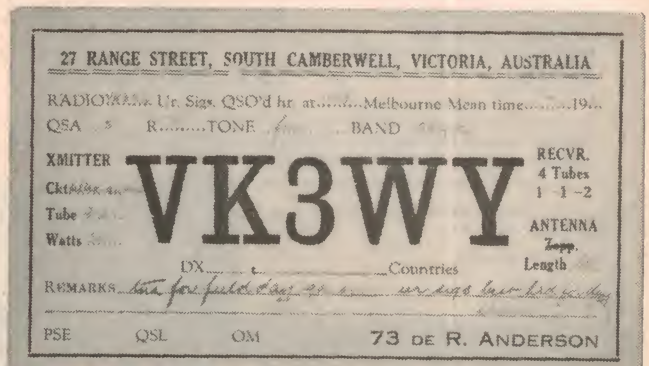
The following extract from John Allaway G3FKM, The Month on the "Air — Radio Communication" February 1981, is to the point, and worth considering.

In an open letter to all DX writers, Rag, LA5HE, raises some pertinent questions concerning the way in which some of the rarer stations are worked these days. He says — "Is almost everybody on the west coast of the USA incapable of working their own DX these days? One Sunday I heard W ..... , who used to be a well known DXer. As it had been several years since I had talked to him I gave him a call and asked him to come 5kHz down with me for a chat.

Much to my surprise he declined because he was too busy .... The reason proved to be that this old-timer in fact was nursing others into QSO's with some Asian stations.

If this kind of contact is supposed to be





Two of the QSL cards received by the late Gil Miles, VK2KI.

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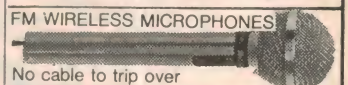

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AMATEUR RADIO

DX-ing, I for one fail to see any point in maintaining a prestigious certificate like the DXCC (worked 100 countries). What happened that day had more resemblance to a telephone service than DX-ing — let alone DX hunting. If QSLs from contacts of this kind are submitted for DXCC and other certificates, I suppose that some of us must feel that we cannot be as proud of our wall paper as we used to be. DXCC used to signify a certain level of operational standard. I guess that it still does on CW. However, it seems to me that the time has come to abandon phone DXCC altogether. On the decline of certain old-timer DXers, perhaps this subject is best left in silence."

The case referred to is not an isolated one; similar comments have been made regarding contacts established through net control stations, or with DX-pedition stations using a control station to nominate the station to be worked. Also, some DX-pedition stations are demanding green stamps (payment) before they will acknowledge that a contact was made and confirm by "QSL" card.

High cost of printing and mailing have had an adverse effect on the practice of QSL-ing direct to the station worked. However, the mailing cost has been minimised by national amateur radio societies around the world establishing QSL bureaus. Operated voluntarily by members, cards are received, sorted, and despatched in bulk to relevant bureaus. Cards received from other bureaus are distributed to members. While this system takes longer, it is the most popular method for distributing the hundreds of thousands of cards circulated between amateurs each year.

Details of QSL bureaus in Australia can be obtained from Wireless Institute of Australia offices in each state.

QSL-ing is not limited to the exchange of cards between amateurs, but has a very wide following among short-wave listeners who send reports, not only to amateur stations but also to local and overseas broadcast stations, and collect QSL cards from those who acknowledge such reports.

To illustrate some of the foregoing comments these are extracts from some of the cards from the late Gil Miles, who held the call signs — A311; VK3KQ and VK2KI, (EA April 1981).

- May 26 1925, 3AGU location Pottstown USA. Transmitter 4 — 5 watt tubes, 2½amps in antenna. Stamps on card to value of five cents. Call sign format no longer used in USA.
- June 23 1925, 6VC location Los Angeles, California, USA. Transmitter — Hartley 50 watts. Receiver two tubes. Call sign format no longer in use. Stamp on card two cents.
- July 31 1925, Z1AX location Te Aroha, New Zealand. Transmitter — Hartley 150 watts. Receiver — detector and two audio stages. Call sign format no longer in use. Stamp on card one penny.
- May 8 1925, A4GM location Brisbane Australia. Transmitter — 6 watt Hartley. Receiver three coil low loss one detector. Call sign format no longer in use. Stamp on card three halfpence.
- July 5 1936, VK3VH location Melbourne Victoria. Transmitter — Pair 45's in push pull, 20 watts. Receiver Super regenerative. Current call sign format. The remark, "First QSO on 2½ metres" (160MHz) probably refers to the early VHF experiments being carried out by amateurs in Australia.
- June 7 1936 VK3WY location Melbourne Victoria. Transmitter — 30 watt using a 210 valve. Band 56MHz. Remarks refer to VHF field day experiments being carried out. Current call sign format.

RTTY PRINTER

DSE GP80 GRAPHIC PRINTER: Recently I (VK2APQ) had the opportunity to try this unit. The aim was to check it as a means of obtaining a hard copy of radioteletype signals, in parallel with the video display and cassette recording normally obtained with the Tono Theta 7000E communications computer. The result was very pleasing.

As the GP80 was reviewed in the July issue of "EA", as interfaced with the System 80 computer, it is not intended to discuss the technical aspects, but rather to discuss actual use in an amateur station.

Interface with the Tono is straightforward, although there is a difference in the data number sequence relating to the pin connections for the interface cable. The GP80 will print 80 characters a line. Characters are not printed as received or when a key is depressed. The data is stored in the memory until a line feed or carriage return (automatic or manual) is inserted. When that occurs the printing function starts and storage of the next line of data commences. It could be referred to as a — store, start/print, stop — function cycle.

Overprinting does not occur, as the carriage return function also activates the line feed of the printer.

A double character width facility, 40 characters per line can be activated by appropiate keys of the Tono.

An excellent printout was obtained of the ANARTS Sunday morning news broadcast from VK2TTY. The 45.5 baud 170Hz shift signal was converted to ASCII output mode by the Tono. The Morse code practice, transmitted on 146.400MHz in Sydney, and on-air RTTY contacts were also printed with the same result.

The performance of the GP80 left nothing to be desired and proved to be a satisfactory companion for the Tono.

There is also a graphic mode in the printer, but time prior to compiling these notes did not allow experiments to be carried out. The Tono has ASCII special characters available from the keyboard, so there seems to be several possibilities to extend the use of the printer, such as designs for QSL card.

WIRELESS INSTITUTE NEWS

The following information was received from WIA federal executive office Melbourne.

At the May meeting the executive decided to seek approval from the Postal and Telecommunications Department for Australian amateurs to use the "AX" prefix for the 1988 Bi-centenary and the 1985 WIA 75th Anniversary.

Also to support the Queensland Division request for the "AX" prefix to be used Australia-wide next year to mark the occasion of the Commonwealth Games to be held in Brisbane.

A new bylaw, 8151108, applicable May 12, 1981 covers the admission of 430-440HMz transceivers into Australia.

Work on the 1981 Australian Amateur Call Book was proceeding well and will include a wealth of reference material.

It is understood that the book will be available in August.

RADIO CLUB NEWS

CENTRAL COAST AMATEUR RADIO CLUB: Included in the June 1981 issue of "Smoke Signals", the club's monthly newsletter, was an interesting illustrated article on a local public works project; the Mangrove Creek Dam.

The inclusion of this type of information is a pleasing departure from the stereotyped comments usually contained in club newsletters. Publication of such articles could encourage a greater awareness of projects within their own community areas. The result would no doubt be of mutual benefit to a club and, say, local government bodies.

Radio clubs and other organisations, as well as individual amateur operators, are invited to submit news and notes of their activities for inclusion in these columns. Photographs will be published when of sufficient general interest, and where space permits. All material should be sent to Pierce Healy at 69 Taylor Street, Bankstown.

The Australian CB SCENE

OLBIS/EA CONTEST: "tremendous response"

As these notes go to print, we are in the closing stages of the contest organised by the Australian CB Scene in collaboration with Olbis Industries of Oxley Brisbane. While the selection of a winner must wait until after June 30, Bernie Bischa and I are already aware that we face quite a job in sorting and evaluating the entries.

At the outset, I was warned by a number of people that I should not expect too many entries, so I took them at their word and didn't allow my expectations to become too great. But were they wrong! The response has been tremendous, and there hasn't been one day go by without still more entries waiting for me in the PO box.

We plan to announce the winners in our next issue.

FROM THE NCRA

Being a member of the NCRA's National Executive, I would like to pass on some information contained in a letter from Mr Ross Ramsay, the First Assistant Secretary, Radio Frequency Management Division, Department of Communications, Canberra. It was in response to inquiries relating to the powers which hire purchase companies have when repossessing motor vehicles, in cases where CB equipment is installed.

It appears that State laws determine what equipment is considered to be a part of the vehicle in such circumstances. The mere holding of a Commonwealth licence for a CB set does not make the licensee immune to those laws.

A further point is that the vehicle is not classed as being a part of the CB station. In fact, there is no such thing as a "mobile station" as far as CB is concerned. The fact that the set is powered by the vehicle's battery, etc, is incidental.

On a somewhat different theme, and further to what I have said in the last couple of issues, the Department of Communications is going to ensure that all state police departments are individually informed about changes to the Act. They will be given explanatory notes, which should obviate some of the misunderstandings about properly licensed 23-channel transceivers.

The NCRA is currently advocating an increase in the appropriation given to the RFM Division in the forthcoming Budget, and we sent a detailed submission on the subject to the Ministers for Communications, Finance, Administrative Affairs, the Shadow Ministers for those portfolios and several other Members of the House and the Senate.

A reply was received from the Minister for Communications, the Rt Hon Mr Ian Sinclair. Mr Sinclair expressed his gratitude to the NCRA for taking an interest in the "health" of his Department. He has instructed some of his officers to meet with officers of the Department of Finance, to seek an increased appropriation to cover overtime, travelling expenses, and the up-dating of equipment.

The Association gained the impression that there may be an increase in licence fees in the not too distant future, but is reserving its stand on the matter pending the outcome of the actions outlined above. Increases could be delayed and/or softened if the revenue received by the Department was increased. More positive action by the Department in policing the bands would help achieve this but it is up to all operators to do their bit by discouraging illegal activities.

Even the most conservative figures indicate that there are at least 100,000 operators on the band who either do not hold a licence or who have never held one. Even placing two of these sets on each licence means an annual loss of revenue by the Department of around $1,000,000. Communications is one area where the amount of money made available to the Department is determined by the amount of revenue received from the "users". The more we pay, the more results we can see to our benefit, and the more pleasurable our hobby can become!

THE "WOODPECKER"

I have had quite a response to my comments on the Russian "Woodpecker" problem. Amongst them was a letter from a gentleman who (for obvious reasons) wishes to remain anonymous. The letter reads:

"Your article in May EA re the 'Russian Woodpecker' was very timely and you are certainly correct in your statement that it is 'not unique to Russia'."

The Australian Defence Department has its OTHR system in Central Australia and elsewhere, called "Project Jindallee" which causes interference to countries to the north of Australia. I wonder how successful you would be in asking the Australian Prime Minister to stop that project?

There are many other Government and non-Government projects which cause interference, much of it unrecognised. For example, the equipment used by the Federal Government's Ionospheric Prediction Service which scans from 2MHz to 30MHz and transmits a 20kW pulse every one fifth of a second mains synchronised. The effect of it on a narrow band receiver is almost negligible . . . . perhaps a few clicks so often just like background noise. On a wide-band receiver it is much more obvious as it sweeps through the spectrum with its 50Hz clicks.

The overall result is that background man-made interference is increasing each year but is disguised as a natural phenomenom. About the only comment one can finally make about this sort of interference to 27MHz CB is that it is time the move was made to UHF and forget the 27MHz band.

Other writers expressed similar sentiments but, in most cases, without advocating a shift to UHF. Maybe they are greedy like me – preferring to hold on to what we have!

Incidentally, I did make mention of this problem to Ross Ramsay some time ago. He mentioned that we had our own OTHR (Over The Horizon Radar) system but that it did not seem to cause any problems because of the way it operates. I have not had the opportunity to double-check with him but his impression certainly does not line up with the above letter.

THE MAILBAG

I received a letter from Mr P. J. Bannister. I haven't forgotten you; I am still looking for the system you need.

A letter also came from WA90 who suggests that the AMers have too many channels and that they are wasted a great deal of the time. He often goes down onto the AM channels on sideband.

Frankly, I wholeheartedly disapprove of sideband operators using the AM channels. I firmly believe that we should all stay with the suggested band plan . . . and this also applies to the emergency monitors who either transmit mainly on channel 5 USB or who feel that they are entitled to leave channel 5 on the sideband mode and QSY to another AM channel, using the same mode, for quick discussions.

From Ken Upton comes the story of a CB (tongue in cheek) "first", in the way of "marine mobile". It occurred on the Nepean-Hawkesbury river system in NSW, with a paddle-powered raft about five metres long, made up from 20-litre plastic drums. On board, Jen, Phil, Keith and Steve (an amateur) had an 18-channel Super Panther and an 800-channel 2-metre hand-held.

That seems to wrap it up again for this month. Send any bits of information to me at PO Box 406, Fortitude Valley, 4006.

Jan Christensen

SHORTWAVE SCENE

by Arthur Cushen, MBE

Pioneer Gospel station celebrates 50 years of operation

Radio station HCJB in Quito, Ecuador this year is celebrating 50 years of broadcasting, while at the same time a 500kW transmitter has been introduced to the shortwave transmissions.

It was on December 25, 1931 that HCJB first began broadcasting, after applying the previous year to the Ecuadorian government for a transmitting licence, which was granted for a 25-year period. There were few radios in Ecuador and no other transmitters at all when HCJB started. One of the engineers began building cheap little radio receivers, a small battery-operated set with no tuning at all, and all you could hear was HCJB.

Since this small beginning HCJB, "The Voice of the Andes", has expanded rapidly and today serves a world wide audience in many languages with a major service to Europe and to the Spanish, Portuguese and Quechua speaking audience of South America. The rapid progress has been matched with technical installations of a high standard and recently three projects were completed – the installation of the new 500kW transmitter, the introduction of a steerable antenna, and the completion of a new hydroelectric plant to supply power for the new installation, according to one of our readers, Charlie Loeven of Surfers Paradise. HCJB has for many years provided its own hydro power, not only for the station and its studios in Quito, but also for staff housing. The balance has been sold to the Quito authorities.

The story of HCJB is one of tremendous dedication in the field of hospitals, missionary work, education and radio broadcasting. Several Australians and New Zealanders are working at HCJB and are often heard in programs to the South Pacific broadcast daily 0700-1030UTC. The transmissions are on 6130, 9745 and 11900kHz and during the period 0800-0930 9745kHz carries a different program. This includes DX Party Line on Monday, Thursday and Saturday at 0900UTC when Clayton Howard conducts an interesting session of news for the shortwave listener.

Notes from readers should be sent to Arthur Cushen, 212 Earn Street, Invercargill NZ. All times are UTC (GMT). Add eight hours for WAST, 10 hours for EAST and 12 hours for NZT.

ENGLISH BROADCASTS

During the listening period up to September 6 the world's broadcasting stations are using the J schedule which means that during the daylight hours in Australia signals from most parts of the world should be received at good level. Here is a summary of English broadcasts which are providing good reception during this period:

Austria: Vienna has two transmissions that carry English to the South Pacific and the broadcast at 0830-0900UTC is now on 21500 and 21640kHz. On Sundays a further 15 minute program "Austrian Shortwave Panarama" is heard from 0900 on 21660kHz.

Bulgaria: Radio Sofia has been heard with two transmissions in English at 0430UTC, one being directed to North America on 11860kHz and the other to Africa on 11735kHz. A further transmission at 0730UTC has been observed on 15160kHz.

Canada: Radio Canada International from Montreal is well received in a transmission 2130-2200UTC on 15150, 15325, 17820 and 17875kHz and on Saturday this program includes "DX Digest" During our afternoons English is broadcast at 0200-0230 on 9535, 9755 and 11940kHz. The broadcasts at 0300 and 0400UTC are 30 minutes long and can be heard on 5960, 9535, 9755 and 11845kHz.

Great Britain: The BBC World Service has made few changes for its transmission to Australia, the program being on the air for 24 hours each day with two periods beamed to the South Pacific. From 1800UTC reception is available on 5975, 9410, 11750, 15070 and 15400kHz. A new frequency from the Singapore Relay Base 15225kHz is used at 1800-1830UTC. At 2000 21560 carries the broadcast and at 2115 a further new frequency, 21690kHz, is in service. The evening listening in our area from 0600UTC is best on 9640, 11955 and 15070 and from 0900 the higher frequencies 21550 and 25650 carry the transmission. When high frequency reception is below normal listeners should try the two Singapore Relay frequencies 9740 and 11750kHz.

Hungary: Radio Budapest has brought forward its transmission by one hour as Hungary is observing daylight time and the transmission is now 0930-1000UTC. Many frequencies carry the service, but 11910, 15220, 17710 should provide the best reception. The broadcast to North America 0200-0230 is also received at good strength on 9835, 11910, 15220 and 17710kHz.

Japan: Radio Japan, broadcasting in English to Australia 0930-1030UTC, has dropped 11875 in favour of 11840kHz for the transmission. There has been considerable interference on 11840 from KTWR Agana Guam, but 15235kHz is still used by Tokyo to this area.

USA: The Armed Forces Radio & Television Service has many listeners in Australia who follow the excellent baseball coverage provided by the station. Recently, studios were moved from Washington to Los Angeles and during our daylight hours signals are best on 15430kHz up to 2300UTC, while another frequency 15345 is heard at the same time. Later 21570 is received up to 0430 and then 11790 with 11805kHz providing the best outlet around 0900UTC. The studios in Los Angles are now at 1816 North McCadden Place, Los Angeles, 90038.

RADIO NEW ZEALAND

The shortwave service of Radio New Zealand now broadcasts to Australia on 11945kHz 0815-1215UTC and on 15485kHz 2115-0815UTC. The transmission is also available on 11675kHz 1800-2145 and 17860 2145-0630UTC. The tentative schedule for September shows that a new frequency 9885kHz is to be used 1800-2115UTC.

"New Zealand Calling," the special program for shortwave listeners, is now broadcast at 0315 and 1015UTC on the first and third Monday of each month and includes a Mailbag and DX feature

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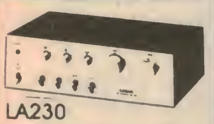

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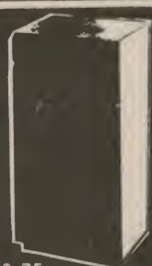

L33-75

SPECIFICATIONS

L22-30
Response: 60Hz – 18KHz ± 5db
Power: 30 watts RMS

L33-50
Response: 50Hz – 18KHz ± 4db
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Response: 40Hz – 22KHz ± 4db
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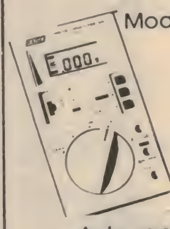

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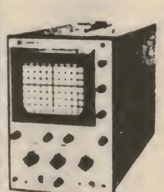

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Books & Literature

Exploring the BASIC Language

50 BASIC EXERCISES: By J. P. Lamoitier. Paper covers, 231 pages, 177mm x 225mm, illustrated with flowcharts. Published by Sybex Inc, USA, 1981. Price $15.55.

This book is designed to teach Basic through a series of graduated exercises. It is written for those who have a minimum scientific or technical background, and contains realistic problems and programs in mathematics, finance, statistics and operations research. All the programs in the book are written in Microsoft Basic, and will run directly on a TRS-80 or System-80 computer, and with minor changes on a PET, Apple or Sorcerer.

The book is divided into 11 chapters. The first chapter begins with a brief introduction and a program for calculating taxable income. The second chapter discusses the development of programs, stressing the importance of a clear definition of the problem to be solved and the use of flowcharts. Throughout the book the author's approach is systematically structured, with an introduction and a conclusion to each topic, supported by clearly explained sample programs and flowcharts.

Chapter three covers exercises using integers, with an unusual set of examples including fractions, prime numbers and number base conversions. Sample programs are written following the logic of the flowcharts derived for each problem, and examples of typical outputs are shown. The next chapter covers exercises in geometry, taking the same approach. Topics covered include the calculation of the area and perimeter of a triangle and curve plotting.

Data processing is the subject of the fifth chapter, with examples covering a Shell sort, merging two arrays, and the construction of a telephone directory program.

Mathematics, including polynomial division and the calculation of definite integrals is covered by the sixth chapter. Financial computations, the next chapter, includes a sales forecasting program, programs for calculating repayments on loans and further examples of income tax calculation programs.

Chapter eight covers games, giving as examples a number guessing game, a matchstick game and a Craps program. Chapter nine provides examples from operations research, including the use of directed graphs to solve problems in scheduling and the efficient use of resources. Chapter ten treats statistical applications, with programs for calculating the average of a series of measurements and the mean, variance and standard deviations. Use of the RND function of Basic is also covered.

The last chapter is "Miscellaneous" and contains a program for calculating the sign of the Zodiac for a given birthdate, and flowcharts and programs for solving the Eight Queens problem, one of the classic puzzles for computer solution. Two valuable appendices conclude the book, the "Alphabet of Basic" (characters and symbols recognised by most Basic interpreters) and an extensive section on the rules and syntax of Basic.

Each chapter of the book begins with simple exercises on the topic covered and proceeds to more advanced examples. The development of each program is fully explained, and unlike many texts on programming this one uses examples which are realistic programs, ready for use in solving real problems in the laboratory, classroom or office. It is not a book for the absolute beginner, as it assumes familiarity with the fundamentals of programming and mathematics, but for those with a technical background or for experienced computer users wishing to expand their knowledge of the topics covered this book is likely to be very useful.

We received review copies from the Technical Book & Magazine Co Pty Ltd, 289-299 Swanston Street, Melbourne and from McGills Authorised Newsagency Pty Ltd, 187 Elizabeth Street, Melbourne, Victoria. (P.V.).

Programming The Sinclair ZX80

30 PROGRAMS FOR THE SINCLAIR ZX80 1K: Paper covers, 111 pages, 140mm × 207mm. Published by Melbourne House (Australia) Pty Ltd, 1980. Price $12.50

The Sinclair ZX80, is one of the cheapest Basic-speaking computers available, and for this reason has become widely used. Software for the ZX80 requires some special features, such as the ability to run in less than 1K of memory, and the ability to run in a program memory whose size changes according to what's displayed on the screen of the computer.

As one would expect, the programs in this new book fulfill these requirements. What, perhaps would not be expected is the variety and range of the programs presented here. If you think the ZX80 is just a "toy" computer, these programs may change your mind.

Some of the programs are games, divided into two sections; "Games to While the Time Away" and "Challenging the Computer". The first section consists of five game programs, including animated versions of "Horse Race" and the old favourite, "Lunar Lander". The section "Challenging the Computer" presents programs in which the user plays against the computer, such as Noughts and Crosses and Blackjack.

The next section "Playing with the Computer" does not contain games programs as such, but five useful routines which demonstrate what can be done with careful programming in limited memory. Included here are a bubble sort program to order the elements of an array, a line renumbering program, and routines which allow the user to enter and run machine-code programs from Basic.

"The Computer as Teacher" consists of four educational programs, including a version of "Hangman", Maths Drill, a quiz on the capitals of the world and a version of "Life" for the ZX80. Mathematical abilities are further stressed in the next section, which provides a program for finding prime numbers, and programs for solving simultaneous equations and square roots.

The book concludes with five more games programs — a bridge bidding tutor, Pontoon and Mastermind, to name three. The final section of the book, called appropriately "Pushing the Computer Limits", contains the most ambitious program of the book, a computer version of the Japanese game of Gomoku, played on a 19 × 19 gridded board. The object is to place counters on the board in a noughts and crosses fashion, but instead of trying for three in a row, you must have five in a row to win.

In order to pack such a long program

into the ZX80's memory, a technique borrowed from larger computers is used extensively. Sections of the program are loaded in and run to set up the board, and then other sections of the program are loaded into the same memory locations, over-writing the original contents. This "overlay" technique effectively increases the size of the memory available to the programmer.

Some care is required to use this approach however. A note on the Gomoku program reads "As long as you don't display line 100 the program functions very well. Should you accidentally press LIST or otherwise get that line displayed the only remedy I can suggest is to delete line 100. The line can then be re-entered".

This is one of several tricks of ZX80 programming illustrated in the book. Quite apart from the value of the 30 programs provided, the text should be an inspiration to other ZX80 programmers in using the capabilities of their machines to the maximum. The programs contain extensive examples of code compression of programs, the use of the PEEK and POKE statements and the USR function.

Each program is supported by notes and explanations in the text as well as by extensive use of REM statements within the programs themselves. A useful feature is the list of line numbers and the parts of the programs which carry out particular functions. This makes following and modifying the programs easy.

All in all this is an excellent book, and can be recommended to any user of the ZX80 or the MicroAce.

Our review copy came from the publishers, Melbourne House (Australia) Pty Ltd, 24 Peel St, Collingwood, Vic 3066. Those ordering by mail should add $1.00 for post and packing. (P.V.)

Electronic Data Books

DATA BOOKS. Transistor. Electronic Information Series, Edition 50. Soft covers, 280 × 212mm, 560 pages. Published by DATA Inc, as a subscription service.

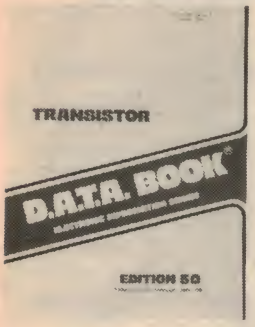
Data books are almost legendary as the bible of the electronics engineer. They are the ultimate guide for substitutions and equivalents for any semiconductor device and they have the virtue of being updated annually or semi-annually. Pictured, is the 50th edition of the transistor DATA book which

CORRECTION

Due to a typesetting error, the price of "The Secret Guide To Computers", reviewed in June 1981 Electronics Australia, was incorrectly listed as $2.75. The correct price is $7.75. We apologise to readers for any inconvience.

covers the period from February to July 1981. It covers all current and non-JEDEC types of bipolar and field-effect transistors, including V-FETs.

The first DATA book appeared in 1956 and referenced a few hundred transistors. Even at the early stage in the development of semiconductor products, the young electronics engineer who founded DATA, Inc recognized the need existent at that time and future need for a systematic presentation of available semiconductor products.



Today there are twenty-one DATA book services referencing all manner of semiconductor and IC products; including transistors, diodes, thyristors; linear, digital, interface, and memory IC; microprocessors and microcomputers and their support chips; optoelectronics, power semiconductors, microwave devices; as well as other services.

DATA books now contain information on nearly 300,000 products. All products are arranged in such a way as to enable the engineer to compare and contrast devices with similar characteristics by looking at one page. Drawings are included for all the various devices to give the engineer a complete picture of any particular product. Manufacturers' names and addresses are also included to make it easy for the electronics engineer to either seek more detailed datasheet information or order samples of products from manufacturers.

For more information about the twenty-one different DATA BOOK services write to Ron Turner, J. H. Book Services at PO Box 311, Chatswood, NSW, Australia 2067.

Interfacing Handbook

MICROCOMPUTER INTERFACING HANDBOOK A/D & D/A by Joseph J. Carr. Soft covers, 350 pages, 210mm × 130mm, illustrated with diagrams and photographs. Published by TAB Books Inc 1980. Price $10.95.

Microprocessors are being used in an ever-widening number of applications, in medical and engineering instruments, as controllers of display devices and various types of machinery. Many of these applications involve the measurement of analog, or continuously variable voltages, or the use of an analog signal to control equipment such as a servo motor of the deflection plates of a CRT device. Digital computers on the other hand operate with discrete voltage levels represented by the binary digits 1 and 0, so some means of translating between analog and digital signals is needed.

Two forms of data converters exist. Analog-to-digital converters (ADCs) are used to produce a binary output that is proportional to some analog input, while the digital-to-analog converter (DAC) produces an output voltage corresponding to the value of a binary word input. The ADC allows analog signals to be monitored by a computer, and the DAC permits the computer to send signals to analog devices.

This latest TAB book is described as a handbook of ADC and DAC interfacing techniques, and it is certainly comprehensive. In 18 chapters the book covers the basic theory of data conversion, analog voltage reference sources, the use of operational amplifiers and analog switches in data conversion circuits, hybrid devices. applications and commercially available devices. The approach is a good mixture of the mathematical and the descriptive, and the text is well supported by many circuit diagrams and charts.

Covering such a wide field in the limited space available means that some areas receive better treatment than others. The actual interfacing of converters to microprocessors is dealt with in only two chapters, and the details given are sketchy. On the other hand, circuits and PCB patterns are provided for the design of both 8 bit and 10 bit A/D and D/A converters in the chapters covering commercially available devices. Software conversion techniques and the use of analog active filters in data conversion circuits are treated in two chapters, but this material must be classed as introductory only.

On the whole the book is a good introduction to the data conversion field, clearly explaining the theory of operation of the various devices available. Each new term introduced is defined, and a useful glossary is given at the back of the book. The mathematical treatment of the subject is particularly good.

Unfortunately the text is marred by a number of errors. Some of these are merely annoying, such as simple spelling mistakes and typographical errors. Some are potentially more serious, such as the substitution of "milliseconds" for "microseconds" in several of the equations given. In addition, some of the devices dealt with in the book may not be readily available in this country.

For the price, Microcomputer Interfacing Techniques is a useful book if you are interested in data conversion techniques. Actually interfacing converter circuits to a microprocessor may require the use of other reference texts.

Our review copy came from the Technical Book and Magazine Co, 289-299 Swanston St, Melbourne 3000. (P.V.)

New Products

Versatile Function generator from Sabtronics

Anyone interested in a source of sine, triangle and square waves should take a look at the Sabtronics 5020. It has a frequency range from 1 Hz to 200kHz and a TTL output for driving 5V logic circuitry. It is suitable for general audio testing of amplifiers and loudspeakers and many other uses in the laboratory or hobby workshop.

The Sabtronics 5020A is housed in a grey impact-resistant plastic case and has a tilting bail so that better visibility of the front panel can be had when on the bench. Colour coding on the front panel is used to distinguish the different controls; orange for the power, green for the function and yellow for the frequency range controls. Blue is used for the BNC output sockets. Overall dimensions of the case are 204 × 84 × 180mm (W × H × D). Mass is 0.74kg.

Standard features found on most general purpose function generators are a frequency control covering the audio spectrum, sine wave output and an output level control.

In addition to the sine wave output, the 5020A can supply triangle and square waves. A DC offset control is also available for level-shifting the function supplied. There are two outputs, High or Low, as well as a TTL square wave output. Also fitted is a sweep input to control the frequency from an external voltage. These are BNC sockets.

Pushbutton controls along the top of the instrument panel allow switching for the Frequency Range, the Function and Power. Dual concentric knobs at either side of the case provide fine and coarse frequency control at the left and Amplitude and DC offset to the right. A small LED indicates the power on and an AC socket at the rear of the case is for external power connection.

All that is required to have the 5020A up and going is a 12VAC plug pack rated at about 400mA.

Frequency ranges available are from 1Hz to 200kHz in 5 ranges. The × 1 range gives from 1Hz to 20Hz and this frequency range can be multiplied by 10, 100, 1k, or 10k to give the overall range mentioned above. The calibrated frequency dial was found to be accurate. The fine adjustment gives about a ±5% control either way.

The external frequency control, Sweep In, allows a variation in the frequency with an external voltage as mentioned above. A simple formula is given so that the range over which the frequency will change can be calculated for the particular change in voltage. (The maximum range cannot be greater than that available from the frequency dial.) For example we found that for a 0 to 10 volt input on the 10k range the frequency can be adjusted from 10kHz to 200kHz, with the frequency dial set on 10kHz.

The High level output voltage can be adjusted from zero to 10 volts p-p and the DC offset adjustable to ±5 volts (driving into an open circuit). Into 600Ω impedance, 5 volts p-p and ±2.5 volts respectively are obtained. With the Low level output, the level can have a maximum of 100mV p-p and DC offset of ±60mV into an open circuit. Into 600Ω impedance, 50mV p-p and ±25mV are obtained.

The TTL square wave output is capable of driving 10 standard TTL loads and is not level shifted by the Offset control. This square wave can be used as a trigger for an oscilloscope or as a direct signal source to a digital circuit.

Distortion of the sine wave signal is of the order of 1% from 1Hz to 100Hz and less than 3% above this frequency. Clearly the generator is not intended as a low distortion generator but as a general purpose unit. The linearity of the triangle wave is better than 1%. We found the rise time of the square wave output to be 18V/μs.

Heart of the circuit operation of the 5020A is the 8038 Function Generator integrated circuit, which provides the sine, triangle and square wave functions. Three op amp packages are also used. All the switches and potentiometers are directly located on the printed circuit board as are various trim potentiometers which allow adjustments for calibration.

The operating manual supplied with the generator is comprehensive: not only does it supply specifications of the unit, but also gives the circuit diagram, circuit description, calibration procedures and application notes such as amplifier frequency response, speaker impedance testing and amplifier overload tests.

Some of the features we liked about the 5020A were: the DC Offset adjustment, the Sweep In voltage control and the TTL output providing a signal which does not swing below ground.

For further information on the Sabtronics 5020A Function Generator contact Christie Rand Pty Ltd, Unit 5, No. 3 Leighton Place, Hornsby, NSW 2077. Postal address is PO Box 48 Epping NSW 2121. Recommended retail price of the 5020A is $253 including 15% sales tax. A pack and post charge of $3 applies to mail order purchases. (J.C.)

Jaycar supplies resistors free of charge

Jaycar Pty Ltd, one of Sydney's upcoming kit and component suppliers, has come up with a good idea. From August 1st, Jaycar will be giving away ¼ watt resistors!

If you are constructing a project that requires an assortment of standard components, such as transistors, ICs, plugs and Jiffy boxes, and also calls for standard 5% tolerance ¼ watt resistors, Jaycar will supply the resistors entirely free of charge, provided that your total order is for $15 or more. The offer is limited to 30 resistors per order, representing a saving of $1.50, or 10%.

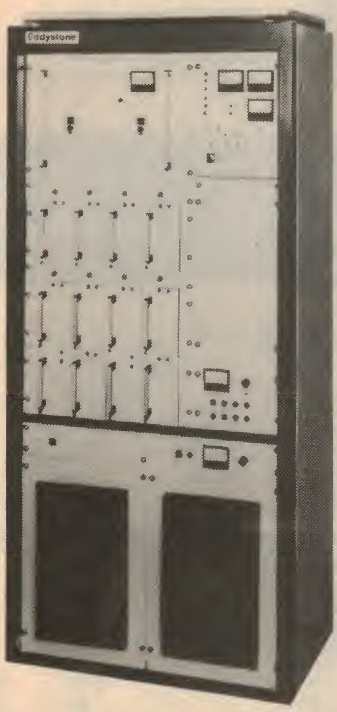
The offer will run for two months, August and September. Gary Johnston, Managing Director of Jaycar, says that if the system is popular with customers (which seems fairly certain) the company will consider making it a permanent part of its service to personal and mail order shoppers.

Jaycar now also has available a wide range of Australian-made Etone speakers at its city showroom. Sizes available range from 15cm (6") hifi types 605 and 608 (as used in the Playmaster 3-18L) to 25cm (10") and 30cm (12") units able to handle 100W RMS. Etone high power PA speakers are also available, in sizes from 25cm to 38cm (15"), capable of handling 200W RMS.

Another of Jaycar's attractions is its free speaker cabinet advisory service. Anyone can call in to Jaycar's city shop and receive free design drawings of suitable cabinets for hifi enclosures, PA bins or monitor boxes. Interstate customers can take advantage of the service simply by sending a stamped, self-addressed envelope to Jaycar.

For power supply constructors, Jaycar now also stock the complete range of Ferguson transformers. The address is 380 Sussex St, Sydney, NSW 2000.

1kW transmitter from Eddystone Radio



At one time the best known name in Australia as far as communications receivers were concerned, the UK firm Eddystone Radio Ltd has taken a much lower profile in recent years. They are still producing professional quality receivers, however, in addition to a variety of other specialist products in the communications field.

Their latest product is a solid state 1kW transmitter covering the frequency range from 520kHz to 1610kHz. The only tuning adjustment of the new B6038E transmitter is in the output tuning stage, and since most of the circuits are duplicated in two separate 500W chains a fault in any part of the transmitter will not put the equipment out of service.

The transmitter is shipped with stabilised power supplies and the modulation shelves removed. All that is required is to re-insert these components on site, connect the output feeder, audio input and mains supply and the transmitter is ready for service.

Eddystone has sold over 40 of the transmitters to the BBC for use within the United Kingdom and is currently manufacturing a BBC-designed FM transmitter drive unit under licence. The TM4L/5 is a low power drive unit (250mW to 4W) together with an 18W power amplifier. Output frequency can be set to any multiple of 25kHz between 87.5 and 108MHz, and output power can be set between 5 and 18W.

Eddystone Radio is represented in Australia by GEC Telecommunications, 21 Biddy St, Chiswick, NSW 2046.

Data acquisition system

A data acquisition system designed for control by a computer has been introduced by Philips Test & Measuring Instruments. The system, the PM 4012, is capable of turning any microcomputer or larger computer into a fully interactive data acquisition system for both analog and digital applications.

Up to 950 analog and/or digital inputs can be handled, with full programming and measurement control in ASCII format. The only requirement for the computer is an interface to the IEC 625 instru-

ment bus (IEEE488 bus), a serial interface or teletype input and output.

Modules can be provided to allow the measurement of a large range of different physical quantities. Available modules include thermocouples, resistance thermometers and strain gauge in full, half and quarter bridge circuits. For testing and development programs, both binary and BCD values can also be entered directly into the computer measurement system.

Sample application programs are available on cassette or floppy disk in Basic for the Commodore PET computer or the Philips PM 4400 IEC bus controller. Detailed application program notes are also available for many other types of computers.

The PM 2012 is designed for use with other Philips IEC bus equipment to form general purpose automatic measuring systems. Applications range from quality control and the testing of goods received to monitoring production lines in factories and laboratory processes.

For further information contact Philips Test & Measuring Instruments, in all capital cities.

GFS has maps for radio amateurs

GFS Electronic Imports of Mitcham, Victoria, once again has available their Great Circle map of the world, centred on Melbourne. The Great Circle map has proved popular with many radio amateurs, as it allows them to accurately determine the range and bearing of transmitting stations.

The Great Circle map, also known as a Zenithal Azimuthal Chart, gives its user the true direction and distance from Melbourne of every point on the Earth's surface, allowing beam type antennas to be directed accurately. The map can also be used, with reduced accuracy, from other locations in Australia.

The map measures 43cm × 32cm, and the price is $2.00.

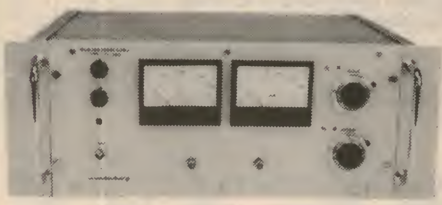
Also available from GFS Electronic Imports are the 1981 Foreign and United States Callbooks. The 1981 Foreign Listings Radio Amateur Callbook now has over 360,000 listings, while the United States Callbook has 398,829 radio amateurs listed. In addition both callbooks provide a wealth of information such as QSL managers, world call prefixes, international postal information, standard time charts and more.

GFS also have the 1981 print of the Radio Amateurs Kit of Maps which consists of three maps and an atlas. Included in the kit are a World Map, a US Great Circle Map and a United States Map.

The US Callbook is priced at $20 plus $3.50 postage, the Foreign Callbook is $19 plus $3.50 postage, and the Kit of Maps is $6.00 plus $2.00 postage.

For further details contact GFS Electronic Imports, 15 McKeon Rd, Mitcham, Vic 3132.

New range of high voltage power supplies



A range of DC stabilised high voltage DC power supplies is now available from Brandenburg Ltd of the United Kingdom. The power supplies are suitable for bench top use or rack mounting, and provide outputs in the range 0-10kV at currents up to 2A. Voltage stability is quoted as better than 0.05%

Shown above is the HVV-2100 high voltage power supply, part of the Brandenburg range.

For more information contact British Merchandising Pty Ltd, GPO Box 3456, Sydney, NSW 2001.

Test instruments from Warburton-Franki

Warburton-Franki now has available the Krohn-Hite 3100A Bandpass Filter Series, which provide continuously tunable high and low cutoff filter settings from 10Hz to 3MHz. The filters are said to be ideal for a wide range of applications, including noise suppression, control of bandwidth for detectors and voltmeters, and as a design aid for fixed frequency filters etc.

The Model 3100A is tunable from 10Hz to 1MHz, with a 24dB/octave slope. The 3103A and 3103A-4 are tunable from 10Hz to 3MHz; the 3103A-4 provides 18dB/octave slope, compatible with IRIG specifications for tape recorder testing.

Also from Warburton Franki is the Krohn-Hite Model 1000A function generator, which features an output protection circuit. The circuit protects the output stages of the function generator from short circuits or the application of a voltage to the output terminals, and resets automatically when the short circuit or applied voltage is removed.

The Model 1000A provides 20V p-p sine, square and triangle waveforms at frequencies from 2Hz to 3MHz, and has a 1500:1 frequency tuning range on each of its three multiplier bands. Additional features include an external frequency control voltage input, a calibrated control voltage output which is proportional to frequency, and an auxiliary TTL output.

For further information contact Warburton Franki Ltd, 372 Eastern Valley Way, Chatswood, NSW 2067.

Marine transceiver

Imark Pty Ltd has available the Sawtron 555 27MHz Marine Transceiver, designed specifically for marine use. Features include the ability to operate on any DC voltage from 10 to 35V, and a case made from corrosion resistant light alloy materials with stainless steel nuts and screws.

A splash-protected, noise cancelling microphone is provided, with a 3-metre cord said to remain flexible even down to -80°C — a boon for intrepid Arctic sailors. The audio output stage of the transceiver delivers 5W into 8Ω, allowing it to be used as a public address system or loud hailer.

For further information contact Imark Pty Ltd, 167 Roden St. West Melbourne, Vic 3003.

REVIEWS OF RECENT

Records & Tapes

CLASSICAL • POPULAR • SPECIAL INTEREST

BEETHOVEN/MICHELANGELI: On no account miss it!

BEETHOVEN — Piano Concerto No. 1 in C Major. Arturo Benedetti Michelangeli (piano) and the Vienna Symphony Orchestra conducted by Carlo Maria Giulini. DGG Stereo Cassette No. 3301 302. Also obtainable on disc.

In the last issue I wrote with all the enthusiasm I could muster about a Michelangeli recital of Chopin Mazurkas. I am again bewitched by the same pianist's performance of this Beethoven concerto. I heard it first a few weeks ago when it was broadcast by the ABC's Channel 2. Even with the handicap of regular TV sound equipment, as compared to true hifi, it was immediately apparent that here was something quite out of the ordinary. After having obtained a cassette from DGG of the same performance I played it on my usual hifi set. It provided a glorious experience.

Michelangeli is like no other pianist in either personality or style. Personally, he is quite without conscience about not turning up at a concert hall full of admirers come specially to hear him, or at a recording studio full of waiting technicians. He makes no excuses. He just isn't there! And his private life is just as mysterious.

In style he seems to combine the virtues of every other leading contemporary pianist without copying any. As a result, his performances differ from all others, yet never jar listeners into thinking them freakish. They are, when at their best, imperishable in what might be called their justifiable originality — an originality that reveals without distorting.

Added to his intellectual grasp of the music is his technical command of every aspect of piano playing — an incomparable tone, a magical control of nuance and sonorities all allied to the very highest achievement of digital (in the old sense) dexterity.

After that paean it would serve no purpose to point out details of this enchanting performance which ranges all the way from the coaxing to the overwhelming. Chords of quite thunderous power are there to offset his innate Italian sense of lyricism. His conception of the work as a whole is in the grand manner but quite without pomposity and with true realisation of the many more delicate and subtle inventions. I am afraid I can only avoid more schoolgirl gush by advising you on no account to miss acquiring it.

I must also pay due deference to the splendid contribution of the Vienna Symphony Orchestra under Carlo Maria Giulini. This will certainly be one of the outstanding recordings of the year and I write aware of the risk I am running in making such a prophecy so far away from December. The cassette sound is fine. (J.R.)

BOULEZ/POLLINI — What does it mean?

BOULEZ — Sonata No. 2 (1948). WEBERN — Variations, Op 27 (1936). Maurizio Pollini (piano). DGG Stereo Disc 2530 803.

For some time now it has been freely rumoured that Boulez has ceased composing, because performers find his music too difficult to play. Although his Second Piano sonata on this disc is an early work (1948) it nevertheless must have daunted any pianist who looked at it for the first time.

It is also reliably reported that that stalwart supporter of the avant garde, Yvonne Loriod, now Madame Messiaen, and a pianist of outstanding ability, burst into tears on examining its difficulties. This was in the early 1950s. Nevertheless she eventually played it to a violently hostile audience.

Since you may be interested in the composer's own description of the sonata's "musical" content I quote him as follows: "At that time what attracted me in the manipulation of the 12 notes was to give them a functional meaning, a motivic and thematic meaning in relation to certain functions which they had to assume in the work". (What the hell does that mean? J.R.) He continues: "This is very easily seen in the first movement:

series of intervals are linked to certain motives, and reappear; this series of sounds is divided into a certain number of motives which supply the whole of the first movement in particular". End quote, which hints at a good reason to suspect the origin of Mlle Loriod's tears!

The Boulez statement about his sonata which accompanies this disc goes on throughout in the same foggy vein and confuses the mind to the same extent as it does the ear.

Now I have a very good idea that the score looks very neat on paper with its "themes" turned upside down, sideways, augmented and diminished in a most ingenious manner. But it must be remembered that the score is only a cipher used by the composer to express his thoughts and that in itself has no further value. It is the ear that counts on what it sounds like and not the eye. I realise that to some readers this statement is old hat but there may still be some to whom it might be useful in explaining one of the more irritating practices of the avant garde, that coterie of composers who after three-quarters of a century have failed to find an audience. I do not include with them such outstanding talents as Berg's, Penderecki's and a very few others.

I must stress however that Pollini's extremely lucid and fluent account makes a few of Boulez claims perceptible without, alas, making them more palatable musically. Here and there you will find some lip service to romanticism and there is no doubting Pollini's conviction of the value of the work. He strikes

Reviews in this section are by Julian Russell (J.R.), Paul Frolich (P.F.), Neville Williams (W.N.W.), Leo Simpson (L.D.S.), Norman Marks (N.J.M.), Greg Swain (G.S.), and Danny Hooper (D.H.).

every note with an obvious purpose.

He also makes Webern's Variations sound like variations although of an alien kind to the musical ear. The engineering of the whole disc is great, the piano tone impeccably faithful and, despite the loudness of parts of the Boulez sonata, never a hint of a clang.

A final quote from Boulez which reveals that even in those early days he had decided where he was going. He writes: "I tried the experiment of completely destroying (the old forms) — I mean by that an attempt to destroy what was first-movement sonata form, to dissolve slow-movement form by means of the trope and to dissolve the repetitive scherzo form by variation form, and finally, in the fourth movement, to destroy fugal and canonic form". Well, at least he's honest about his destructive intentions! (J.R.)

SCHUBLER CHORALES
. . . impressive organ sound

THE SIX SCHUBLER CHORALES. J. S. Bach. Myrtle Reiger, organ. (Plus other tracks.) Mark Levinson Acoustic Recording Series, Volume 1. [From M. R. Acoustics, PO Box 165, Annerley, Qld 4103. Phone (07) 48 7598.]

Most clasical organ recordings are replete with jacket notes on the composer, the music, the soloist and the organ — especially the organ, its history and its specifications. Not so on this disc. Despite an inner sleeve, composer, music and musicians are identified only by name, and the organ itself is ignored.

The only piece of prose relates to Mark Levinson's purist approach to the recording, made with the aid of a high-speed wide-format analog tape recorder (shades of Enoch Light and his 35mm film format). But Mark Levinson adds French processing with "virgin vinyl".

As for the purist approach, that it certainly is. There is no editing, no splicing between tracks. The mood of the original concert performance is retained, with the audience applauding, then subsiding into a discrete fidgeting hush while the organist prepares for the next number.

And then the organ — and let me simply say that, direct cut and digital notwithstanding, you won't hear cleaner organ sound anywhere. And so through side 1 (the Six Chorales) to track 1 on side 2: Prelude in E flat Major, also by Bach. Very, enjoyable.

Side 2 continues with the Battle Chapel Choir, directed by Charles Krigbaum, with Britt Wheeler available at the console. That's the only clue as to the possible venue for the recording: "Rejoice in the Lord" (Anon); "Magnifica" (Tallis); "Lord, Let Me Know Mine End" (Greene); "O Sacrum Convivium" (Morales). The choral sound is very clean but the real impact of the recording is from the organ.

But why the anonymity? I am left with an intriguing thought: Is is really a very clean sounding pipe organ, or could it be one of the new generation of amazingly pipe-like electronics? (W.N.W.)

RAVEL IN MONO
"Beautifully clear"

RAVEL — Complete piano works. Robert Casadesus with sometimes Gaby Casadesus when two extra hands are needed. CBS Masterworks Mono 77346. Three mono discs.

I first came across Casadesus (recorded) as a most fastidious Mozart player back in the old days of 78s. He was a delightful stylist in complete sympathy with his medium. It was not until the very early days of LP that I recall him as a Ravel player — so early that it was before it was customary to put the record title on the spine of the sleeve. They were issued undated by Philips and I still have them.

Despite the competitive versions that have been issued since then, these three tastefully boxed monos were well worth reissuing, this time by CBS. Casadesus was, for quite a while, a close companion of Ravel, according to a short note on his life by his widow Gaby, who collaborated with him in many of these pieces for piano duet or duo.

The two men met for the first time in 1923, just after Casadesus had played Ravel's suite Gaspard de la Nuit. Ravel had congratulated him on his performance, "particularly the slow and nostalgic manner (in Le Gibet) that the composer had intended". The quote is from Gaby's notes.

While I entirely agree with Ravel's estimate, I am interested that he apparently made no comment on Scarbo in the same suite which, though it may be due to the early recording process, is rather too lightly handled compared to other performances I have heard of the work, notably Giesekings just after the war in the Sydney Town Hall.

It was in the lighter works, though not necessarily airy ones, that Casadesus excelled. In these, his control over soft passages and his elegant French phrasing, allied to advice on their interpretation at hand from the composer himself, all contribute to the present reissues' value. Apparently from 1923 on Casadesus always included a Ravel work in his recitals.

He never visited Australia to my knowledge. I personally met him and his wife when they were staying at the same hotel in Vienna back in 1965 and had frequent conversations with them after dinner whenever there was no important musical event to attend. They were delightful companions to meet so fortuitously, a rewarding experience I shall never forget.

By the way, although the original LPs I referred to above were issued in Australia by Philips, they were recorded by American Columbia in New York. That they were in mono is not such a handicap as it might sound to some, since a solo instrument gains little from stereo treatment. The sound on these reissued discs still sounds beautifully clear and quite faithful, if a little on the light side. (J.R.)

☆ ☆ ☆

BEETHOVEN — Piano Concerto No. 3 in C Minor. Svjatoslav Richter (piano) with the Vienna Symphony Orchestra conducted by Kurt Sanderling. DGG (Resonance) Stereo Cassette No. 3335 107.

I must write with much less enthusiasm about this one. When this great Russian pianist first recorded, I responded as excitedly as did most other Western critics to his manifest talent. He was introduced in recitals of Schumann and other romantics right up to his contemporary Prokofieff and excelled in all of them. Here, most of us thought, was one of the greatest finds of the century.

But strangely, in all the years since then, I never heard him play Beethoven until I received this cassette. And I must record astonishment at the extent of my disappointment. True, his dazzling technique remains unimpaired and he, like Michelangeli, can play a run so fast that it sounds almost like a glissando. But absent in this performance are many of the elements that made him such a figure of worship at his earlier appearances.

In fairness I should mention here that the original disc was issued back in 1963,

a period when I was spending much of my time overseas, which explains why I haven't heard the performance sooner.

I have no idea of the engineering quality of the original but I must mention that the cassette under review uses Dolby noise reduction. It is acceptable but the sound is coarser and the dynamic range is narrower than more modern examples of cassette engineering.

However none of this affects the interpretative quality of Richter's performance and that is where my disappointment concentrates. Absent are many of the graces that I have always expected of him. That his approach to Beethoven — at any rate in this work — is rugged, is to put it mildly. I had better add that Beethoven himself attracted a good deal of criticism along those lines at some of his own performances but, in recalling this, the general style of performance during that period must be considered. There is also the well known fact that composers are not always the best performers of their own compositions!

Again I must add that, listening to this recording, I was also surprised by the uncharacteristic coarseness of the playing of the Vienna Symphony Orchestra. Speaking generally, many of Richter's tempos in the first two movements are slow, at times lagging enough to be tiresome. That this is not the fault of the conductor can be deduced by his quite noticeable hints to his soloist to move things along a little. Also, if Richter used these speeds to intensify delicacy, he failed. Missing immediately is his usually lovely lyrical sense of melodic line nuanced to perfection.

Here and there his shapes are almost square. His entry into the jolly Finale is inexcusably brutal. The sound throughout is so forward that some adjustments to volume must be made and, even then, the balance between soloist and orchestra favours first one and then the other quite bewilderingly.

I am truly reluctant to have to write in this way about an artist I admire so much and I would also remind readers that the date of transfer to tape of this disc is not mentioned. I haven't heard the disc but there is not enough evidence to blame the cassette engineering for the failure of the exercise. (J.R.)

☆ ☆ ☆

J. S. BACH. The Art Of Fugue. Members of the Philomusica of London directed by George Malcolm. Two-record set. World Record Club stereo R 05859/60.

What is a fugue anyway? And what is a canon? These two types of musical composition are related and are both to be found on this two-record set. A canon is a composition in which the same melody is repeated by one or more voices or instruments, overlapping in time and in the same or a related key. Most people are more familiar with it when "rounds" are sung. By contrast, a fugue is a polyphonic musical form in which the melody theme or themes are stated sequentially and then developed in counterpoint.

Bach was the master of fugue and he wrote this set of pieces with the idea of demonstrating the full range of variety possible from both fugue and canon. Unfortunately, he did not complete the set and he gave no indication of what instruments he intended for their performance. This means that there are several versions of the work which are different interpretations. This arrangement is by Leonard Isaacs.

Clearly, anyone who appreciates and wishes to learn more of the works of Bach will find "The Art of Fugue" very satisfying. I certainly did. Recording quality is good.

The nineteen pieces in "The Art Of Fugue" are arranged in the following order: Contrapunctus 1, 2, 3, 4, 5, 6 — Canon — Contrapunctus 7 — Canon At The Octave — Contrapunctus 8 — Canon At The Twelfth — Contrapunctus 9 — Canon At The Tenth — Contrapunctus 10, 12a, 12b, 13a, 13b and 11. (L.D.S.)

☆ ☆ ☆

DON BURROWS AND THE BRAZILIAN CONNECTION Cherry Pie CPF 1035-2. [Cherry Pie Records, PO Box 225, Pennant Hills, NSW 2120. Phone (02) 819 6151.]

Anyone with an empathy for jazz, particularly with a Brazilian flavour, will find a veritable feast for the ears in this two record album, featuring The Don Burrows Quintet, George Golla, and the Sydney String Quartet, together with the two Brazilian guitarists, Octavio Burnier and Claudio Cartier.

Most of the compositions are the work of these two visitors. Some of the titles are: Prossiga — Don Joao — Manha de Carnival — Insensitez — Pedra Pintada — Barranco — Marcante — Artmanhas — Ficarum Nus.

There are nineteen tracks in all, the

Ravel/Slatkin in digital

RAVEL: Bolero; Daphnis and Chloe (Suite No. 2) Pavane Pour Une Infante Defunte. Leonard Slatkin, St Louis Symphony Orchestra, St Louis Symphony Chorus. Digital master stereo, Telarc DG-10052. [From P. C. Stereo, PO Box 272, Mt Gravatt, Qld 4122. Phone (07) 343 1612.]

Anticipating what Telarc might do with Bolero, in the way of dynamic range, I set the volume at the beginning at the merest whisper, and waited for a climax that somehow didn't come. So I had to do it all over again, without the same enthusiasm. But, somehow, this Bolero didn't seem to come alive.

Band 2, side 1 "Pavanne pour une infante defunte" was a little more promising but still without that crystalline clarity of sound that one has grown to expect from Telarc. Only last month, I hinted at a similar reservation about Dvorak's "New World" Symphony from the same Conductor, Orchestra and venue.

There's more sheen to "Daphnis and Chloe" on side 2 but, even then, it's not until the last few minutes that the orchestra lets go with anything to remind you that you are listening to a new kind of disc technology.

I'm not saying that this is a bad recording or one that lacks a potential for enjoyment; simply that I didn't find in it the qualities that one might expect of a premium-priced audiophile disc. (W.N.W.)

RECORDS & TAPES — continued

original recordings have been made by the ABC mobile recording unit at the Sydney Opera House and the Canberra Theatre. Some of the tracks break away from the normal jazz idioms, becoming almost chamber music in their sound. Overall, with excellent recording quality and musicianship, the album is something to enjoy time and time again. (N.J.M.)

☆ ☆ ☆

GILBERT & SULLIVAN. The Grand Duke or The Statutory Duel. The D'Oyly Carte Opera Company and The Royal Philharmonic Orchestra conducted by Royston Nash. World Record Club stereo RO4471. Two-record set.

This Gilbert & Sullivan opera was new to me and it was not until I read the sleeve notes that I realised why it was unfamiliar. It was the fourteenth and last opera composed by Gilbert & Sullivan and, apart from the original production in 1896, was not performed professionally again until 1975, by the D'Oyly Carte. In two acts, it demonstrates Gilbert's ability to produce a charming plot, with some very complicated marriage situations in this case. The performance on this two-record set is the complete opera.

It goes without saying that the performance has some very memorable songs and a piece of ridiculous whimsy in the "secret sign of the sausage rolls".

On the last occasion that I reviewed a record by the D'Oyly Carte Opera Company I had just been lucky enough to attend a performance in Sydney by the D'Oyly Carte on its first-ever overseas tour. I thoroughly enjoyed the live performance but found the equivalent performance on record quite disappointing because of the poor recording quality. This is definitely not the case with this record. The record is brilliant with excellent clarity and wide dynamic range.

There is but one proviso if you decide to purchase this thoroughly delightful performance. Make sure that you have a magnetic cartridge capable of the very best tracking performance. Two of my cartridges failed in this regard on one passage on side one. I should also mention that surface "prickle" was evident at times on both pressings.

And when you do buy this set, do not start to listen in the morning as I did. I am afraid I spent a good part of the day listening and re-listening. Depending on your point of view, that can be a very good way to pass a day. (L.D.S.)

☆ ☆ ☆

THE HOT JAZZ DUO. Judith Durham, Ron Edgeworth. Stereo, Interfusion (Festival) L-37473.

In his jacket notes, Californian jazz writer Steve Fleming has this to say: "Upon hearing the Hot Jazz Duo, the first thoughts that come to mind are how refreshingly uncomplicated, how straightforward, how stridently soulful these young musicians from Australia sound. From the first bars, informed jazz buffs will recognise that singer Judy Durham and pianist Ron Edgeworth have

CHARPENTIER: Te Deum

"I found this record a joy . . ."

CHARPENTIER: Te Deum, for soloists, chorus and orchestra; Grand Magnificat, for eight parts, two instrumental groups of soloists, chorus and orchestra. Martha Angelici and Jocelyne Chamonin, sopranos; Andre Mallabrera, counter-tenor; Remy Corazza, tenor; Georges Abdoun, baritone; Jacques Mars, bass; Maurice Andre, trumpet; Marie-Claire Alain, organ; Jean-Francois Paillard Orchestra; conducted by Louis Martini. World Record stereo disc R 04695.

Marc-Antione Charpentier (1635-1704) is one of many worthy composers who would still be little beyond a footnote except in the most learned of musical histories, but for the voracious appetite of contemporary record collectors and FM radio. He worked in Versailles, it is true, but in a very subordinate position — to play in the Masses celebrated for the Dauphin only.

Even though his contemporaries knew little about him, Charpentier was a most industrious composer; much of his non-liturgic music is, in fact, very derivative and often warrants the scorn poured onto it by Debussy. The church music, on the other hand, is often very good and, thanks to the composer's efforts to rid himself of his Italian learning, quite original. In the two works on this excellently engineered disc, there is a wealth of fine music, both for voices and for the instrumentalists who often have to play deliberately exposed lines. I might add that all the artists perform beautifully and that I found this record a joy from beginning to end. (P.F.)

connected with the roots of their music."

I quote that phrase because it says it all. Even if you are not particularly fond of female jazz vocalists as a race, it is difficult to imagine anyone not being attracted by the sheer keyboard fluency of Ron Edgeworth.

Most of the tracks were recorded live at the Newport Jazz Festival, in New Jersey, in 1978. The remainder were taped by the ABC at the Odeon Theatre in Hobart in the same year: My Buddy — Nobody Knows When You're Down And Out — Open Up Them Pearly Gates — A Good Man Is Hard To Find — Body And Soul — Just A Closer Walk With Thee — Ain't Misbehavin' — Mood Indigo — He Will Remember Me.

As Steve Fleming says: "refreshingly uncomplicated" and the sound is fine. (W.N.W.)

☆ ☆ ☆

20 GOLDEN GREATS. The Bush Music Club. Stereo, Harlequin L-25365, (Festival release).

If Australian bush ballads are to your liking, you'll get a generous helping in this album, compiled from recordings dated between 1964 and 1980. Here are the titles, somewhat abbreviated:

Roaring Days — Eureka — Shearer's Dream — Charlie Mopps — Botany Bay — Drover's Dream — Jog Along Till Shearing — Wallaby Liz — Jacky Jacky — Whip and the Spur — Stringbark Tree — Men Who Made Australia — The Drover — Andy's Gone — Andy's Return — 16,000 Miles From Home — Flash Stockman — Dinkey Di — Flash Jack from Gundagai — Moreton's Bay — Peach Picker's Song.

That's a real cross section of "Australiana", done with simple easy-to-follow vocals, and unpretentious "bush" instrumental backing. The sound quality is quite okay.

Shot a bit more wood on the fire and settle back! (W.N.W.)

For information on World Record Club albums, contact the club at 605 Camberwell Road, Hartwell, Victoria, 3124. Tel. 29 3636.

NOSTALGIC MEMORIES. 18 songs from the world's greatest singers. World Record Club, WRC R-05957.

As I remember it, this album has been around for some time but, of course, the songs are much older again — when singers did not take refuge in heavy backing or electronic gimmickry. Here are the singers and the songs:

Anni Frind: Nun's Chorus. Peter Dawson: The Good Green Acres Of Home, The Mountains Of Mourne. Richard Tauber: Goodbye, Pedro The Fisherman. Gladys Moncrieff: Vilia. Joseph Schmidt: The Happiest Day Of My Life, Tirikomba. Jan Kiepura: Tell Me Tonight. Beniamino Gigli: La Paloma, Mamma. Webster Booth: Take A Pair Of Sparkling Eyes; Paul Robeson: Ol' Man River. John McCormack: Believe Me If All Those Endearing Young Charms. Joan Hammond: The Green Hills Of Somerset. Jussi Bjorling: I Dream Of Jeannie. Marian Anderson: Softly Awakes My Heart. Gracie Fields: Ave Maria.

If you belong to the generation which produced these artists and these songs, you'll enjoy recapturing their mood, despite the age and the limitations of the mono recordings — not stereo as branded.

If you're of more recent vintage, you'll probably have your own ideas about who are "the greatest"! (W.N.W.)

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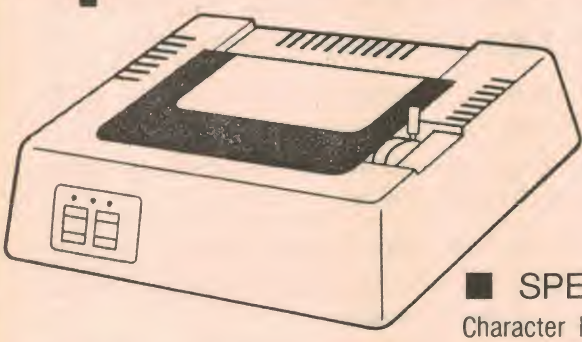

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Column 80

by JAMIESON ROWE
Technical Director, Dick Smith Electronics

Parallel ports and Centronics printers

Puzzled by technical computer jargon like "printer port", "Centronics interface", "RS-232C communications port" and so on? A basic idea of what these terms mean can be worthwhile, even if you're only planning to buy a ready-made computer system and use it to run off-the-shelf software.

This month I thought it might be a good idea to discuss some of the basic concepts involved in connecting up a computer to things like printers and modems. Not to bamboozle you with the technicalities of design, but more with the idea of giving those about to buy a computer system enough knowledge to be able to select the various components and assemble a system which does exactly what they want.

Perhaps the first thing to do is explain the terms "port" and "interface". Essentially, these both mean much the same thing; they are both used to refer to any section of a computer which is provided to allow you to connect the computer to the "outside world".

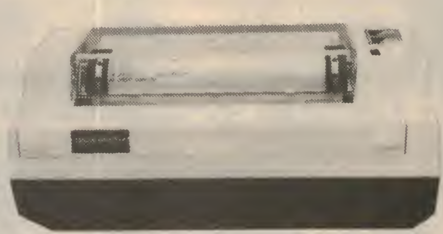
If you like, a port or interface is the internal circuitry associated with each socket which may be provided on the computer to allow you to plug in one of its "attachments" or peripherals. So that if the computer has provision for you to plug in say a printer, the "printer port" is that part of the internal circuitry associated with the printer socket. Similarly if the computer has a socket to plug in a communications modem (for exchanging data over the telephone network), the circuitry associated with this socket will be described as its "communications port".

As you may have gathered already, all information within a computer is handled in the form of binary numbers — groups of 0's and 1's. This applies even in the case of normal English text, where each letter is represented within the computer by a particular binary code number. code number consists of seven bits, in most cases, with a unique combination of the seven bits to represent each letter.

So that when any of this information is sent out to a peripheral device like a printer, it is sent out in the form of a sequence of these binary codes. The peripheral device does the decoding back into letters and other symbols.

Now there are two basic ways in which the binary codes can be passed between the computer and the peripheral: the various bits (each 0 and 1) which make up the code can be either sent simultaneously, on separate wires, or they can be sent one after the other on a single pair of wires. The first approach is called **parallel** communication, while the second is called **serial** communication.

Whichever approach is used, there must generally be some way for the circuitry at each end to let the other end know its status. The "sender" must be able to signal when it has a new code ready for transmission, and the "receiver" must be able to signal when it is ready to receive a further code. This sort of exchange of status information is known as "**handshaking**".

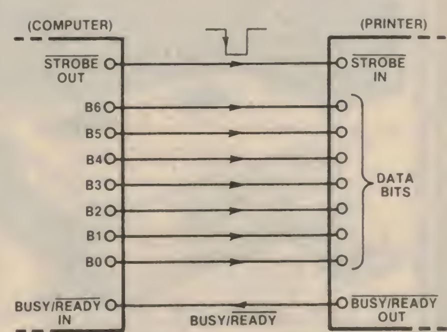


Above: the GP80, a low cost printer which uses a Centronics-type interface. At right is a diagram of the standard interface.

Most low-to-medium priced modern printers are designed to accept information from the computer in parallel fashion, using the particular method of handshaking first used by the Centronics printer company in the USA. As a result, most personal and small business computers are provided with a parallel-type printer port, designed for this method of handshaking. So this is what is meant in specifications when you see the term "Centronics-type parallel printer port".

Basically a Centronics-type parallel printer port involves two special control signals in addition to the seven (or possibly eight) data bit signals. One control signal is a STROBE signal (negative logic), used by the computer to signal the printer when a new character code is available. The other control signal is a BUSY/READY signal, used by the printer to inform the computer whether it is "busy" processing the last code (logic high), or "ready" to process another (logic low).

When the computer has a character to send to the printer, it first checks the printer's status via the BUSY/READY line. If the printer is busy, it either waits or "does something else" until the printer indicates that it is "ready". Then the computer sticks the new character's code onto the data lines, and sends a STROBE pulse to indicate that a new character is available. The printer then starts processing this character code, signalling that it is "busy" while this is going on. Finally when the printer is ready to receive another character code, it changes its status line to "ready" and cycle can be repeated.



BASIC CENTRONICS-TYPE PARALLEL PRINTER INTERFACE

In contrast with this character-by-character handshaking technique used for parallel communication, serial communications tends to adopt a "coming ready or not" approach. In fact a lot of serial communication makes no use of handshaking at all, the "sending end" simply assuming that the "receiving end" will keep up.

But we've run out of space this month, so we'll look into the basics of serial communication next time.

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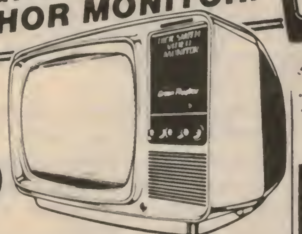

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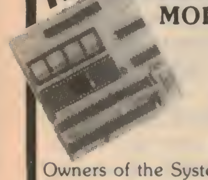

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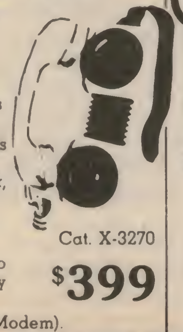

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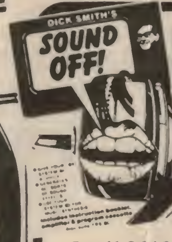

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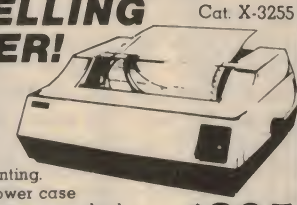

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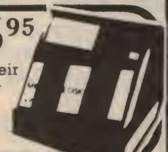

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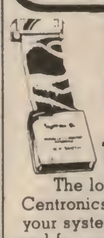

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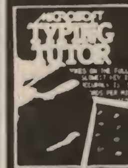

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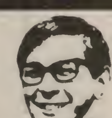

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Microcomputer News & Products

Analog-to-digital converter for the Commodore

Effective use of a computer to monitor and control other equipment frequently requires the use of an analog-to-digital converter. The PETSET1, from Edible Electronics, provides a 16-channel A/D converter system for any Commodore computer. Based on the AIM16 A/D converter module, the system is supplied set up and ready for use - just plug it in and go.

An analog-to-digital converter opens up many new possibilities to the computer user. With the appropriate input scaling circuity, for example, the PETSET can turn your computer into a 16-channel digital voltmeter for automated testing of equipment. Attach some strain gauges and the computer becomes a digital scale. Used with a series of filters your computer and the AIM16 module can act as a frequency spectrum analyser, or perhaps an automated sound level meter.

The CmC AIM16 (Analog Input Module) is a 16-channel analog-to-digital converter designed to work with most microprocessors. Each of the 16 analog inputs is sampled and converted, in sequence, into an 8-bit digital value.

When combined with the correct adapter and cables for connection to Commodore CBM and PET computers, the AIM16 system is known as the "PETSET1", the subject of this review.

PETSET consists of three modules. The first, PETMOD, comprises two printed circuit boards linked by a short piece of ribbon cable and terminated by two 24-way edge connectors. The edge connectors plug into the user port and the IEEE interface at the rear of the CBM computer, and adapt the computer's bus for use with the AIM16. A nice feature is that these two boards duplicate the existing ports in addition to providing connection points for the A/D module, so that the converter can be used without tying up the CBM's parallel port and IEEE port.

The second module of the set is the AIM16, the actual converter itself, in a metal box 160mm × 155mm × 35mm (W X D × H). It is connected to the "port expansion" boards by a 60cm length of ribbon cable.

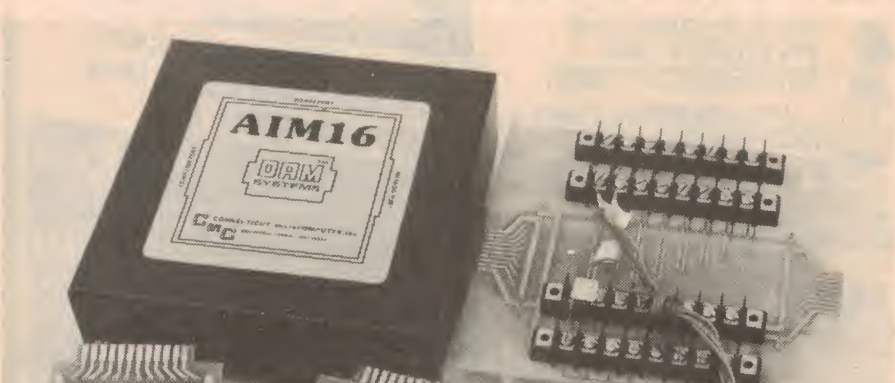
Connected to the conversion module in MANMOD1, a circuit board which provides four terminal strips with screw connections for analog inputs, ground and reference voltages, and an additional edge connector for the attachment of further CmC modules. This circuit board plugs directly into the AIM16 module and makes interfacing a wide variety of transducers a simple process.

Connection of the system is easy. The two expander ports plug into the interface slots at the rear of the computer and the supplied ribbon cable is used to make the connections to the combined AIM16 and MANMOD modules. Power for the A/D converter is supplied by a small 12V plug pack (also supplied).

Once the system is connected it can be used with simple Basic statements. The address and control information necessary to select an input channel and start a conversion is sent over the IEEE interface bus using a POKE instruction from Basic. On completion of the conversion the AIM16 module sends an "end of conversion" signal to the computer. The digital value of the selected analog input can then be read from the CBM's user port using a PEEK instruction.

Any voltage in the range 0 to 5.12V, applied to one of the sixteen inputs, will be converted and a digital value returned which can be read by an appropriate program. Resolution is given as one count per 20mV (256 × 20mV =5.12V), and conversion time, although dependent on the actual value being measured, is typically 80us. Worst case conversion time (for an input close to 5V) is 100us.

A 10-page instruction manual comes with the PETSET, and contains a circuit diagram which reveals the basic simplicity of the design. The AIM16 module is based around the National ADC0817 16-channel single chip A/D converter. The chip has 16 analog inputs, four address inputs to select one of the analog inputs for conversion, a start conversion



PETSET1 is made up of three modules. The port expander boards are shown in front of the AIM16 converter, with the MANMODI board slotted into place on the right.

Micronews Continued ►

input, an end of conversion output signal and an 8-bit parallel data bus. Clock and control circuitry and a reference voltage source complete the unit.

Two types of input can be connected to the AIM16. The first, called a ratiometric input, uses the 5.12V reference voltage in a divider network, with a sensor which produces an output proportional to the reference voltage. The analog inputs are measured as a percentage of the full scale reference voltage, not as absolute values. Potentiometers and strain gauges are examples of ratiometric transducers.

The second type of device supplies its own power and generates an output signal using its own reference voltage. When using this type of equipment with the AIM16 it is important that the analog input voltage does not exceed 5.12V, otherwise the inputs of the ADC0817 could be damaged. As in the case of the ratiometric input, the analog input being measured is compared to the internal reference voltage of the AIM16 and a relative value returned.

With the use of a joystick and a simple program I was able to put the PETSET to some tests. Each of the two potentiometers of the joystick is connected between ground and the 5.12V reference source, and the slider of each pot is taken to one of the analog inputs of the AIM16 module. The module then produces a digital value which is proportional to the position of the potentiometer. By treating these values as parameters in a TAB or POKE statement the joystick can be used to draw on the screen.

Joystick interfaces are of course available which are much less complex and expensive than the AIM16, and this use of the module was intended only to demonstrate its operation. The real value of the PETSET is in industrial and manufacturing operations, security monitoring and general control applications. Any transducer which produces an output voltage in the appropriate range can be connected to the module. This includes pressure sensors, light meters, temperature gauges, humidity sensors, position feedback pots and tachometers, among others. The computer can then be used as an "intelligent" central monitoring station for a variety of situations and processes.

The PETSET1 is available from Edible Electronics, 50 Park St, Abbotsford, Vic 3067. The price is $449 including sales tax, and delivery is free throughout Australia. The PET computer used for this review was made available by Commodore Microcomputers, 3 Campbell St, Artarmon NSW, 2064. (P.V.)

The Video Interface Computer is coming

Edible Electronics has released more details on the new Commodore VIC20 (Video Interface Computer). The new computer is expected to be available in Australia shortly, and should sell for less than $500.

The VIC has a full size keyboard including four user-definable keys. The screen display (on a standard colour television set) consists of 23 lines of 22 characters each, with 64 ASCII characters and the PET graphics character set. Eight background colours, 16 foreground colours and eight character colours are available.

Four sound generators are built into the Video Interface Computer. Three of these are tone generators for musical notes, while the fourth is for special sound effects and includes a white noise generator. The VIC comes with PET Basic and 5K of RAM, which can be expanded to 32K with the addition of plug-in modules.

A wide range of accessories will also be available for the VIC.

For further details contact Joel Gottlieb at Edible Electronics, 50 Park St, Abbotsford, Melbourne, 3067.

Q.T. Computer Systems opens in Sydney

The local microcomputer market has been widened with the establishment of Sydney specialist firm Q. T. Computer Systems (Aust). Using proven design and manufacturing techniques, the company has developed a range of microcomputer systems at highly competitive prices.

The systems are designed for both businessmen and engineers and can be used for accounting and word processing as well as a variety of scientific applications. Software is currently available for Accounts and General Ledger, Medical Practice administration, Real Estate offices and Legal Office Accounting, among others.

The company will modify its applications software to suit individual business and industrial users, and as the user's requirements change the systems can be re-configured for multi-user operation and hard disk storage.

Q.T. Computer Systems (Australia) are also agents for California Computer Systems, and now has available the CCS 2422 Floppy Disk Controller board. The disk controller is an S-100 compatible board which can control four single or double-sided disk drives. It can read and write both single density (FM) and double density (MFM) soft sectored disks.

Included on the board is a 2K disk monitor program and bootstrap loader for CP/M. A digital phase locked loop is used for data separation, for maximum reliability, and write precompensation circuitry is included for double-density operation. Data and Address lines on the board are fully buffered.

The 2422 disk controller board is supplied fully assembled and tested for $376 with full documentation including the disk monitor EPROM and a copy of CP/M from Digital Research.

Q.T. Computer Systems is at 283 Clarence St, Sydney, NSW, 2000.

Micronews continued p127 ▶

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Above prices include all cables and connectors where applicable but do not include sales tax. (Dealer enquiries invited.)

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Microcomputer News & Products

Graphics printers for the Apple II

The Seikosha GP80 Graphics Printer is available through Electronic Concepts Pty Ltd for users of the Apple II who are looking for a low cost printer.

The GP80 features precise graphics resolution, single and double width characters, the full ASCII character set (upper and lower case), and low power consumption (12W) and is available from Computerland stores throughout Australia.

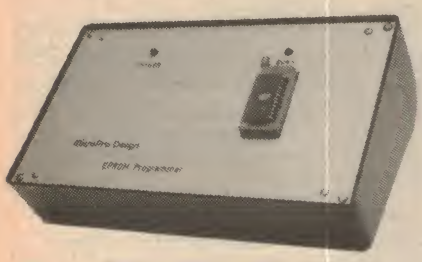
Also available from Electronic Concepts is the "Infroscribe" range of dot matrix printers, which feature full 136 column printing at 10 characters per inch, with a wide variety of printing options such as double size characters, bold printing, 10, 12 and 17½ cpi printing and fully programmable forms handling.

The Model 500 is the basic unit, while the Model 1000 offers a graphics option and printing speeds of 180 characters per second. The Model 1500 will print at 360 cps, and the Model 2000 offers word processor quality printing, with characters formed by 18 over-lapping print needles, at 100 cps.

All of the printers have optional character sets or software loaded character sets and print buffers of up to 3K bytes.

For pricing and further information contact Electronic Concepts Pty Ltd, 55 Clarence St, Sydney, NSW, 2000.

Commodore computers program EPROMs



MicroPro design has announced the availablity of a versatile EPROM programmer for the use with the Commodore Microcomputer. The programmer is capable of programming all 1K, 2K and 4K Eraseable Programmable Read Only Memories (the 2708, 2716 and 2532 respectively), and can handle both single 5V chips as well as types requiring three supply voltages.

A menu of commands presented on the video screen of the computer allow the user to program, copy, read, display and modify the contents of an EPROM. All of the capabilities of the EPROM programmer are under control of the computer, so that the programmer module itself is simple and requires no controls. The EPROM to be copied is inserted into a Zero Insertion Force socket on the top of the unit. Two LEDs indicate Power On and Busy status.

The control program for the module is normally provided in a Read Only Memory chip for installation in the computer, but can be supplied on Floppy disk or cassette if required.

For more information contact Andrew Mowat, MicroPro Design Ltd, Suite 205, 6 Clarke St, Crow's Nest NSW, 2060.

Data '81 "Chips" awards

A new series of annual awards for achievements in the Australian computer industry will be introduced in conjunction with Data '81 this year. The awards will be conducted by Graphic Directions Pty Ltd, organiser of the annual Data exhibition and seminar series.

The "Data Chips Awards" will cover six categories — the most innovative computer application of the year, the best computer science student of the year, the best computer article of the year, services to the Australian computer industry, the best computer advertisement of the year, and the computer professional of the year award.

Winners will receive a specially designed "Chips" trophy, and the awards will be presented at the official Data Dinner Ball to be held in the Grand Ballroom of the Sydney Hilton Hotel, August 25th 1981.

Anderson Digital has Centronics printers

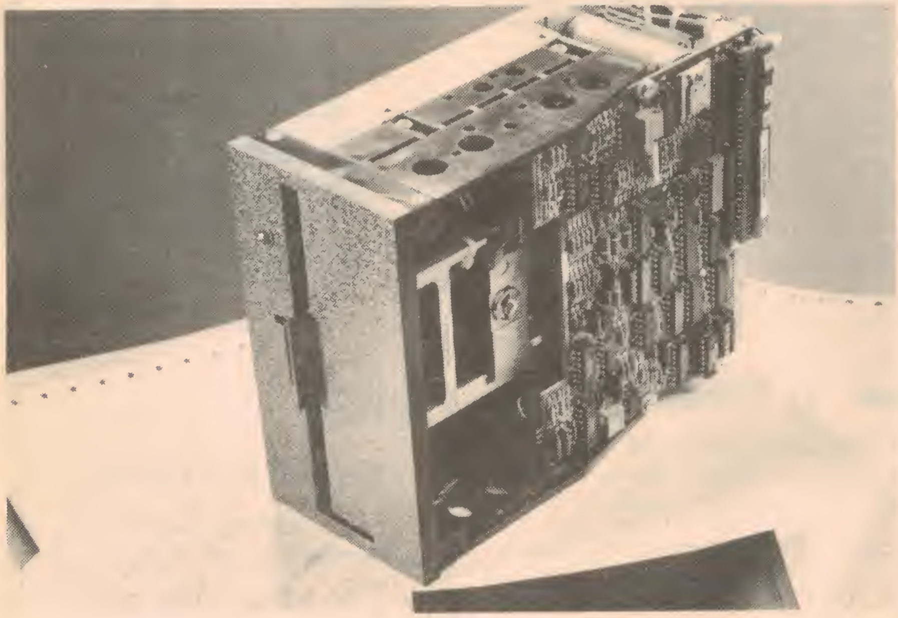
Centronics Data Computer Corporation announced recently that it had appointed Anderson Digital Equipment Pty Ltd as a distributor of Centronics products for the Australian and New Zealand markets.

In making the announcement, Mr Warren E. Allen, Vice President, Field Operations, said "Anderson Digital Equipment, under the direction of General Manager, Bill Anderson, will provide Centronics with an aggressive, professional and knowledgeable marketing organisation to accommodate future growth".

Micronews continued p128 →

Microcomputer News & Products

MPI minifloppy drive stores a megabyte



MPI (Micro Peripheral Inc) have released a new 14cm (5¼") floppy disk drive which they claim will challenge the dominance of 20cm drives in many applications. The new Hi-D (High Density) B92 series drives can store up to one megabyte on a double-sided disk, and feature a track-to-track access time of 5ms. As on the larger drives, a head load solenoid is a standard feature, which reduces the wear on the disk and the read/write head.

A series of the drives is available from MPI, with 40, 77 and 80 track versions, available in either single or double-sided models. All of the drives are plug compatible with industry standards, and applications include upgrades and add-ons for microcomputers and mass storage in process control equipment and remote data logging devices.

The drives will be distributed in Australia by Daneva Controls Pty Ltd, 66 Bay Rd, Sandringham, Vic 3191.

New Apple-II distributor

Delta Semiconductor Peripherals of Victoria have been appointed an Australian distributor for Apple computer products, following an agreement signed in June between DSP and Delta Communications, Apple's sole Asian distributor.

At the same time the distributorship agreement was signed, Agent-Dealer arrangements were completed in all States.

"We are confident our appointment will bring an accelerated growth in Apple sales and in the number of Apple computer dealers throughout Australia" said Mr Mark Thompson, National Sales Manager for Delta Semiconductor Peripherals.

For more information contact DSP, 4th Floor, 520 Collins St, Melbourne, Vic. 3000.

New computer clubs

• The Northern and Western Suburbs Computer User's Group recently changed its address, to CP/M Data Systems, 284 Union Rd, Moonee Ponds, Vic 3039. The president of the group, Mr David Coupe, can be contacted on (03) 370 9590.

• A Forth Interest Group has been formed in Brisbane. A letter from the Group informs us that meetings are currently held on the first Tuesday of each month at Wally Brake's house, but fails to give Mr Brake's address. At present members of the group have versions of Forth running on CP/M, Sorcerer and 6809 systems, but are interested in hearing from anyone who would like to know more about the Forth language. You can find out more by ringing Wally Brake on (Brisbane) 38 4568, after business hours.

• A Texas Instruments TI-99/4 Users Group has been formed in Sydney. The Group produces a monthly magazine with information and assistance for TI-99/4 users, and are prepared to assist anyone in other states in setting up their own Users Group.

Volume 1, No. 2 of the Group's News Digest includes information on programs available and new developments from TI, such as the Extended Basic Command Module, which among other things supports the loading and running of TMS9900 assembly language programs. Useful tips for increasing the running speed of programs and finding out how much memory a program uses are also included.

For more information write to Shane Andersen, the Group co-ordinator, at PO Box 101, Kings Cross, NSW, 2011.

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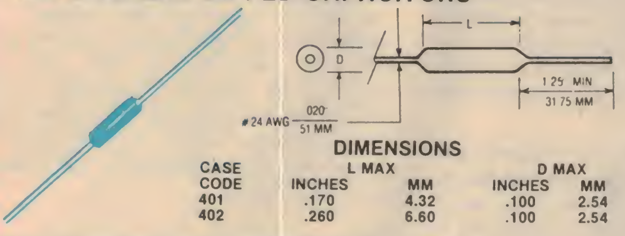

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CASE CODE	L MAX INCHES	L MAX MM	D MAX INCHES	D MAX MM
401	.170	4.32	.100	2.54
402	.260	6.60	.100	2.54

CAP.pf	VOLTS	CASE CODE	TYPE	PRICE 1-9	PRICE 10up
15	100	401	EO/K	.20	.17
18	"	"	"	.20	.17
22	"	"	"	.20	.17
27	"	"	"	.20	.17
33	"	"	"	.20	.17
39	"	"	"	.20	.17
47	"	"	"	.20	.17
68	"	"	"	.20	.17
68	"	"	EO/J	.22	19
100	"	"	EO/K	.21	.18
120	"	"	"	.21	.18
150	"	"	"	.21	.18
180	"	"	"	.21	18
220	"	"	"	.21	.18
270	"	"	"	.21	.18
330	"	"	"	.21	.18
390	"	"	"	21	.18
470	"	"	"	.21	.18
560	"	"	"	.21	.18
680	"	402	"	.21	.18
820	"	"	"	21	18
180	"	401	EM/K	.15	.13
220	"	"	"	.25	.20
270	"	"	"	.25	20
330	"	"	"	.15	13
1000	"	"	"	.17	.15
1500	"	"	"	.15	.13
6800	"	"	"	.16	.14
.1uF	"	402	ES/M	.10	.08

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5018	.150	3.81	.150	3.81	.100	2.54	.100	2.54	.020	.51
5020	.200	5.08	.200	5.08	.125	3.18	.100	2.54	.020	.51
5032	.300	7.62	.300	7.62	.150	3.81	.200	5.08	.025	.64

CAP.pf	VOLTS	CASE CODE	TYPE	PRICE 1-9	PRICE 10up
12	100	501	EO/J	20	17
100	"	"	EO/K	.15	.13
820	"	"	EO/J	.20	.17
10K	"	"	ES/M	.15	13
1K	200	"	EM/K	.25	.20
.1uF	50	502	ES/Z	.12	.10
2700	"	"	EO/J	.27	.22
2700	50	503	EO/J	.30	.25

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302EO100RC220J	22	5%	.22	.18
302EO100RC151J	150	5%	.38	.32
302EO100RC271G	270	2%	.90	.80
302EO100RC331J	330	5%	.22	.18
302EO100RC391J	390	5%	.23	.19
302EO100RC471J	470	5%	.25	.21
302EO100RC471G	470	2%	.55	.45
302EO100RC470K	470	10%	.20	.16
302EO100RC102G	1Kpf	2%	.55	.45
302EO100RC102J	1Kpf	5%	.27	.23
302EO100RC122J	1K2pf	5%	.28	.24
302EO100RC152J	1k5pf	5%	.28	.24
303EO100RC222J	2K2pf	5%	.28	.24
303EO100RC272J	2K7pf	5%	.30	.26

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CK05BX821J	820	200	.30	.25
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CKO5BX102K	1Kpf	200	.25	.22
CKO6BX332M (20%)	3K3pf	100	.20	17

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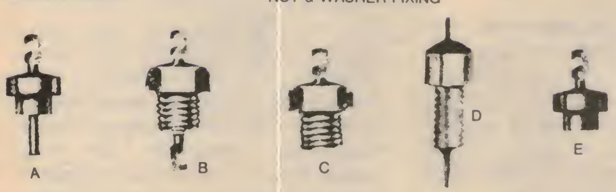
54-803	Ditto	SS50	"E"
54-807	Ditto	SB3A	"C"
54-779	Resin Seal-Bushing		"D"
54-794 & 54-803	SOLDER PREFORM		
54-804 & 54-807	NUT & WASHER FIXING		



CAP.pF.	Tol	Code No.	Description	Illust	Price 1-9	Price 10up
100	20%	FA5C	54-794-002-101M	"A"	0.75	0.55
1000	GMV	FA5C	54-794-002-102P	"A"	0.40	0.32
100	20%	FB2B	54-804-002-101M	"B"	1.00	0.85
470	20%	FB2B	54-804-002-471M	"B"	1.00	0.85
680	20%	FB2B	54-804-002-681M	"B"	1.30	1.00
1000	GMV	FB2B	54-804-002-102P	"B"	0.85	0.65
100	20%		54-779-004-101M	"D"	0.50	0.38
1000	GMV	SB3A	54-807-002-102P	"C"	2.00	1.50
1000	GMV	SS5D	54-803-004-102P	"E"	1.10	0.90

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ERRORS & AMENDMENTS IN SUPPLEMENT CATALOGUE WITH EA & ETI AUGUST 1981.

Page 2 "The mighty **Midget" TO3 Potentiometer** . . should be 1KΩ **Winchester etc Header Plugs.** Should read: 14, 16 & 24 Way.
Page 3 Buzzers: **Picture of PBA24 should** also read PBA12 & PB36. **Knobs-Knobs. Large knob is Type "A".** Small knob Type "B".
Page 4 Wire Wound **Trimming Pots: 100, 200 & 470c** should read Ω's.
Page 7 Cannon & Switchcraft Connectors: "NEVER TO BE REPEATED" refers to the **AMPHENOL 5 pin Connector**. ARLEC Plug **Pack: Model No. PS369 is now PS499.**

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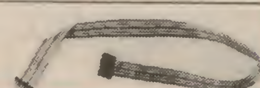

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INFORMATION CENTRE

PLAYMASTER MOSFET AMPLIFIER: I am constructing your latest Playmaster amplifier and have come across two problems that you may be able to help straighten out.

Firstly, I can see no use for connection pin 27 on the PCB overlay; I gather it may have something to do with the input selector wiring. Would you please explain. Secondly, can the choke as used in the March '81 guitar amp be used in the Mosfet amp; it would save us the trouble of winding it ourselves if it is suitable. (A.H., Adamstown Heights, NSW).

● Pin 27 was originally provided for in the design of the PCB so that the preamplifier output leads could be shielded if necessary. However, in the final design, pin 27 was not used. And yes, the choke used in the guitar amplifier can be used in the Playmaster Mosfet stereo amplifier.

STEREO INFRARED REMOTE CONTROL: I have recently completed construction of the Stereo Infrared Remote Control Unit (October 1979) and found the unit to work satisfactorily. However, my present problem is trying to purchase a reasonably priced piece of infrared filter for the BPW34 photo-diode.

Could you offer any suggestions as to where a suitable filter could be purchased or as an alternative, could a BPW50 photo-diode with a built-in filter be used in place of the BPW34 diode? If so where can a BPW50 diode be purchased from? (S.D., Bellerive, Tas.)

● The BPW50 is a drop-in replacement for the BPW34 and can be purchased from any of our advertisers who stock parts for the Infrared Relay featured in our April 1981 issue.

STEREO INFRARED REMOTE CONTROL: Is there any reason the receiver of the October 1979 Stereo Infrared Remote Control shouldn't be built into the current MOSFET Stereo Amplifier project? If not maybe the LEDs could be mounted directly around the volume control, the PCB mounted above the amplifier PCB using spacers and the transformer mounted in a small external box if interference from it would be a problem for the amplifier. If these projects could be built together could you indicate what connections need to be made? (P.W., Thornbury, Vic.)

● While theoretically there should be no problems in integrating the Infrared Remote Control with the Playmaster Amplifier, you should approach the project with the full realisation that there could be practical problems in obtaining completely satisfactory performance.

If you do attempt the project, we would recommend that you do not use a separate transformer but use the Ferguson PF 4361/1 transformer which has an outer copper strap and two extra 15V windings which can be used to derive the ±5V supplies for the infrared receiver circuitry.

PLAYMASTER 145 MIXER: I require some information regarding a Playmaster 145 Mixer described in February, March and April 1975, that I am building, and I have problems with the input preamplifier.

I own a Uher 4200 Moss Stereo tape recorder. The output is 1V/15kΩ. Could you please explain how I can make 15kΩ input on this preamp. The diagram is on page 38 of EA, March 1975.

On this diagram there is a choice to change to four inputs but I cannot work out how to have a 15kΩ input. (G.P., Hectorville, SA.)

● Since your tape recorder has a comparatively high level output of 1Vrms, it will not require a preamplifier board. All that you need do is to connect a 5kΩ resistor in series with one of the 10kΩ level controls to obtain a 15kΩ input. Then adjust the sensitivity as required with the level control.

Problems with capacitor discharge ignition

CAPACITOR DISCHARGE IGNITION: I recently constructed a CDI system and fitted it to my 1973 Leyland Mini. It starts well and idles well but when a constant speed is maintained (cruising) the engine runs very rough (appears to backfire at times). There is no sign of a miss while accelerating; only when you ease off to maintain a constant speed.

I did find the capacitor across the distributor points was leaky and replaced it with a new one, this did improve matters slightly. There has been a new distributor cap, points and HT cables fitted, also another coil was tried. The CDI fitted to my 6-cyl Holden for four years was also tried with exactly the same results.

With the vacuum advance line disconnected there is a big improvement, also by increasing the value of the .22μF capacitor in the trigger circuit there is a further small improvement, but the problem is still there. I have followed all instructions contained in the construction manual.

Also I have been told that when a CDI is fitted to a vehicle the existing capacitor across the points should be removed (which I have not done). Would you please advise me if this is right.

● Answering your last question first, it is not necessary to remove the capacitor across the points when CDI or transistor ignition is fitted to a vehicle. It does not affect the operation of the circuit and it is desirable that it be left in place should you want to make a quick change back to the standard Kettering ignition.

Regarding the rough running of the vehicle when cruising at a constant speed, we are inclined to suspect the initial advance setting on the distributor rather than the CDI circuit. This is indicated by your noting that removal of the vacuum advance line gave an improvement.

MUSICOLOUR III: I am at present contemplating building the Musicolour III as featured in your September 1976 issue and would like to ask a few questions about the design before I start.

The potentiometers specified are either "log" or "lin" types and I was wondering which had the most "linear" control of the sensitivily and brightness.

Could you also tell me how much current the unit draws so that I can obtain an appropriate transformer here in New Zealand? (To be perfectly honest I haven't asked for one listed in the article by name and number yet as judging from previous attempts at obtaining transformers in New Zealand the numbers don't mean much here.)

I would also appreciate it very much if you could tell me how to wind chokes and wire up a circuit for RF interference suppression, and whether it's worth making. (Would shielding the unit in steel help?)

Could you tell me how close this unit can be mounted to hifi gear while still avoiding picking up the noise.

Does the RF radiation only interfere with radio reception or can an amplifier pick it up directly?

Excluding the RF radiation, does the very action of the Musicolour (switching on and off lights) produce noticeable noises ("clicks") from a stereo system sharing a common mains power point (or even in the same house as) with the Musicolour.

I appreciate that you may not be able to give me any definitive answers to many of my questions, but any opinions that you could give would be appreciated. (I.K.B., Christchurch, NZ.)

● First of all, we should note that the Musicolour IV published in this issue supersedes the design you are contemplating building. The new design is more effective in its display as well as having four channels and chaser features. The type of potentiometer is not really critical since the level controls do not need to be varied often and there is plenty of latitude in the settings for a satisfactory display.

RF interference from the Musicolour should not cause any problems with your amplifier, but may affect radio reception depending on the relative positions of the antenna and the wiring to the lights.

WIND GENERATOR: In July '78 you published an article on a wind generator using a Bosch alternator. How can you make an electric motor work as a generator such as in an electric car? Are AC motors the only ones that can be used as a generator? What is the difference between a DC and AC electric motor? (R.D.G., North Ipswich, Q.)

● Generally speaking, any motor can be used as a generator provided that its field windings are energised with a suitable value of current. As for your question regarding the difference between an AC and a DC motor, there may be no difference at all in principle, as in the case of universal motors. But this subject is far too complex for us to give you an adequate answer in these columns. We suggest you obtain a suitable textbook on electric motors from a technical bookstore.

FLUORESCENT LIGHTING: Have you any plans for a project or article on high efficiency fluorescent lighting, preferably of 12 volts. I ask this because, with the looming energy crisis, I think it would be worthwhile investigating such things as best frequency of operation, types of tubes available, current in relation to light output (is light output linear with current?) and best (most efficient) inverters — power mosfets maybe? (D.J.S., Tamworth, NSW.)

● While we have no immediate plans for an article on inverter-driven fluorescent lamps, we have doubts about their relevance for high efficiency lighting. For high efficiency, we doubt whether fluorescent lights, compare well with low voltage incandescent or quartz halogen lamps. We agree that the latter are preferred for a concentrated beam whereas the fluorescent gives a diffuse light.

Having said that, it is also difficult to design an efficient inverter circuit to drive tubes with a rating higher than 20W.

There is an optimum frequency of operation, generally around several kilohertz but at these frequencies, mosfets are less efficient than bipolar transistors, because bipolars have lower saturation voltages.

Finally, the light output is essentially linear with current and dimmers can be used on this principle.

LED VOLTAGES: Not so long ago, I bought ten red LEDs and just yesterday I put one in a radio as a power pilot light. Thinking that it would work at 1.6VDC only, I put in a pot and turned on. At 1.6 volts, the LED was very dim, so I changed the voltage slowly until it was well over 2.0 volts.

The radio made some rude sounds as the voltage got too high, but when all was going well, the voltage across the LED was over 2.0 volts. Have I got some strange LEDs, or do some work from high voltages? (D. M. Paeroa, NZ.)

● At a forward current of 20 milliamps, most red LEDs have a voltage drop of around 1.6 to 1.7 volts, with some units going as high as 2.0 volts. This voltage will be increased for higher forward currents. Since most red LEDs do provide optimum brightness at an average current of around 20mA, we suggest that you check the current to see that you are not pushing the LED beyond its limits.

25W GUITAR AMPLIFIER: I intend to build the 25W Guitar Amplifier (March 1981) and have a query regarding the 2N5459 FET in the Tremolo section. The pin configuration of the circuit diagram appears to conflict with the PC board overlay diagram. According to the pin connections, the flat should be to the outside of the PC board rather than as shown on the overlay. I am using an MPF105 FET which has the same pin connections as the 2N5459. Hoping you can clear up this point. (P. M., Robindale, Vic.)

● The flat of the FET, Q6, should face the opposite way to the outside of the PC board. The GSD markings on the overlay are correct. Thank you for bringing this error to our attention.

ELECTRONIC IGNITION: I have been purchasing EA for fifteen years. In that time, I have been singularly impressed with your policy of building and testing your own projects. I was one of many who eagerly awaited your opto-electronic breakerless ignition trigger. What a disappointment! You didn't build it or test it and the components are not locally available — in fact the article was just a "space filler" for the June edition.

I really want to build this kit. Can you be more helpful than your article? Please don't spoil the best electronics magazine in the country. (M. W., Southport, Qld.)

● All parts for the Opto-electronic Ignition System (EA, June '81) should be available from Radio Despatch Service (869 George St, Sydney 2000) by the time this issue appears in print. These parts include the PCB, the 5401 IC, the TIL81 phototransistor, and the TIL31 infrared LED.

Radio Despatch Service had to directly import some components, and their arrival in Australia took longer than initially expected. We apologise to readers for this delay.

Your point on building and testing projects is cogent. However, we have a high regard for "Wireless World" and, in this case, felt reasonably confident of the validity of the design.

DREAM: This is in relation to the DREAM 6800 substitue circuit for the 6875 clock chip as published on page 85

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of the August 1979 issue of EA.

Since only four inverters are used on the 7404, can the remaining two inverters be used in such a way to produce a "power-on-reset" pulse as is available on pin 12 of the 6875?

In your handbook, "Introduction to Digital Electronics" there are some simple circuits shown producing such reset pulses using Schmitt triggers. I think such a circuit will be very useful to other DREAM users using the substitute clock circuit. (K.G.V., Butterworth, Malaysia.)

● It is not essential to use a Schmitt trigger inverter in either of the power-on-reset circuits shown on P62 of "Introduction to Digital Electronics". A normal inverter element may be used if desired, since neither circuit depends on the hysteresis characteristic of the Schmitt trigger. The Schmitt trigger inverter tends to produce a more rectangular pulse, with shorter rise and fall times, but this is not a critical factor in the DREAM circuit.

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CAPACITOR DISCHARGE IGNITION: Recently I have made the Capacitor Discharge Ignition System as described in the July 1975 issue and am experiencing two problems. Firstly, the unit will not operate properly on 12V (to be specific, anything over 8V). With the points closed, the coil makes a lower pitched whistle and I have a continuous spark at the spark plug (on full 12V).

Secondly, once I reduce the input voltage to 8V the pitch of the whistle gets higher and the continuous sparking stops. I now find that I get a spark as the points both open and close.

I have checked the voltage across the 1μF capacitor (or 2 × 0.47μF units as I have) and found that I get 310V for a 12V input and 250V for an 8V input. I have triple checked the wiring and coil connections and replaced all of the semiconductor devices but all to no avail (the old components are used in other circuits and operate satisfactorily).

Once the unit is operating properly would it be safe to impregnate the coil to reduce the whistle? (P.C., Reynella, SA).

● The symptoms you describe lead us to suspect that either the feedback windings or the primary windings have the wrong number of turns which is preventing the inverter from operating in its correct voltage range. It looks as though you will have to pull the transformer core apart to check the number of turns.

When operating correctly, you may impregnate the transformer but we would not expect much reduction in the whistle unless you went as far as to completely "pot" the unit.

ENGINE ANALYSER: I find your Digital Engine Analyser featured in the October 1980 invaluable for tuning my Sigma with the breakerless ignition system. However I have run into difficulties with this instrument when used simultaneously with a xenon power timing light.

With the timing light connected and the engine running at 650-700rpm, the tacho reading is completely erratic. Dwell and voltage readings seem to be OK. (B.C, Fairy Meadow, NSW.)

● We tried our Digital Engine Analyser with a timing light and found that it did cause display jitter as you describe. The solution involves earthing the chassis of the analyser. Connect the negative lead from the battery directly to a lug mounted on the chassis and then to the earth on the board.

Notes & Errata

25W GUITAR AMPLIFIER (March 1981, 1/GA/22): An error appears on the PC board overlay diagram on page 60 of the March issue. The "flat" of the FET, Q6, should face the opposite way, to the outside of the PC board. The GSD markings on the overlay are correct.

HEART RATE MONITOR (April 1981, 2/MS/58): An error appears on the PC board overlay diagram on page 57 of the April issue. IC5 is shown as a 16-pin device, when in fact it is only a 14-pin package. The IC should be located such that pin 1 of the IC coincides with the pin "1" shown on the overlay. The two spare pads at the end of the IC should be joined together with a link across the width of the IC, connecting pins 7 and 8 of IC5.

ON SCREEN GRAPHIC ANALYSER (March 1981, File No. 1/SC/11): The 15pF capacitor in series with the 8.86MHz crystal may have to be increased up to 47pF for some crystal makes, to ensure a colour picture. It has also come to our attention that not all UM1082 TV modulators are correctly tuned, so they may require some adjustment to obtain a signal within the range of the fine tuning control of a TV. This adjustment involves bending the internal tuning coil of the modulator.

If you intend to use the graphic analyser merely as a display rather than for room equalisation we would also suggest that the "C1" capacitors in the filter/rectifiers be reduced to around 1/5th of their value. This shortens time constants leading to a more dynamic display.

STORAGE CRO ADAPTER (November 1980, File No. 7/C/32): Positions 1 to 8 on switch S4 should be reversed on the wiring diagram and PC overlay, so that the switch positions comply with the front panel overlay.

DREAM 6800 PROGRAMS: (June, 1981); The listing for the Pools Number program on p92 contains a misprint. The third line of the listing should begin with the address 00A0, and the fourth line should begin with 0200, not 0020.

DIGITAL ENGINE ANALYSER October 1980, (File No. 3/TM/16): The digital display may "bounce" in some situations, particularly when the instrument is used with a timing light. The solution is to earth the chassis. Connect the negative lead from the battery directly to a lug mounted on the chassis and then to the earth on the PC board. There is also an error in the parts list: the .037μF capacitor should read .027μF.

MICROACE Z-80 (July 1981, page 102): In our review of this computer kit, it was stated that, apart from external differences, it was identical to the Sinclair ZX80. We now understand that there may be some internal mechanical and electrical differences between the two.

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The best Sorcerer Software in the World. Utilities and games. Free postage! Quick delivery! for **FREE CATALOGUE.** Write or phone:–

P.J.B. SYSTEMS, 24A SIMPSON ST, BONDI 2026. Ph: (02) 30 1839

WANTED:
A copywriter who can think like Dick Smith . . .

You know the ideas Dick comes up with: zany – attention grabbing – some even say ridiculous! But they work!

Trouble is, Dick is so busy and the company so big we need more of these ideas. We need, in fact, a promotions wizz-kid: just like Dick.

But we need more than this: we also want a superman who can write good selling copy. Dick Smith style copy – from someone who has a reasonable technical knowledge, but still has a sense of humour.

You must be able to type – and you'll be expected to do all sorts of things you wouldn't expect a copywriter to do.

Intrigued? Why not come up and see me sometime. It could be the start of a beautiful friendship.

But first of all, give me a call:

Ross Tester,
Advertising Manager
Dick Smith Electronics
Phone (02) 888 3200

CLASSIFIED ADVERTISERS

To the Advertising Manager, ELECTRONICS Australia, Box 162, Beaconsfield, 2014.

- Please insert the following advertisement in the first available issue.
- Tick the classification required ☐ FOR SALE ☐ WANTED ☐ FOR HIRE ☐ CLUBS ☐ POSITION VACANT ☐ POSITION WANTED ☐ READER SERVICE ☐ OTHER

Please print in ball-point pen using capital letters only where necessary.

____

Signed . . . .

Address . . . .

. . . .

I enclose Cheque/Money Order for $ . . . .

being full payment for . . . . letters at $3.00 for 40 letters or part thereof (minimum 80 letters).

L. E. CHAPMAN

122 PITT ROAD, NTH CURL CURL.
MAIL ORDERS: BOX 156, DEE WHY, NSW. 2099.
TELEPHONE 93-1848.

RESISTORS

150 ohm, 5W	20c
10 ohm, 5W	20c
47 ohm, 5W	20c
12 ohm, 3W	20c
2.5 ohm, 3W	20c
33 ohm, 3W	20c
8 ohm, 10W	25c
4000 ohm, 10W	25c
100 ohm, 5W	20c
330 ohm, 10W	25c
220 ohm, 5W	20c
5 ohm, 5W	20c
220 ohm, 10W	25c
950 ohm, 3W	20c
115 ohm, 5W	20c
10 ohm, 5W	20c
1k ohm, 5W	20c
5000 ohm, 5W	20c
6.8k ohm, 3W	20c
3300 ohm, 10W	25c
6800 ohm, 10W	25c
1500 ohm DUAL, 21W	50c
50 ohm, 5W	20c
330 ohm, 5W	20c
1k ohm, 5W	20c
820 ohm, 5W	20c
12 ohm, 10W	25c
470 ohm, 7W	20c
4700 ohm, 4.5W	20c
5000 ohm, 10W	25c
8.2 ohm	5W
3.3K	7W
27 ohm	5W
10K	7W
2 5 ohm	3W

CAPACITORS

2000 MFD 25V Chassis mount	
0.56 250V	40c ea.
2000 MFD, VDcw25	75c ea.
0.0039uF, 1500V	20c ea.
6N8, 1500V	20c ea.
0.0068uF, 1500V	20c ea.
1200PF, 400V	10 for $1
0.068uF, 400V	5 for $1
2200PF, 630V	10 for $1
0.47uF, 250V	10 for $1
0.10uF, 400V	5 for $1
0.082uF, 160V	10 for $1
26k, 250V	10 for $1
0 041uF, 400V	10 for $1
0.033uF, 250V	5 for $1
0.027uF, 100V	20 for $1
220uF, 10V	10 for $1
1uF, 350V	10 for $1
470uF, 40V	5 for $1
1000uf, 16V	25c
2 2uF, 200V	10 for $1
0.047uF, 1500V	50c
47uF, 25V	4 for $1
680uF, 40V	50c
22K, 100V	20c
330uF, 25V	25c
2.2uF, 200V	30c
470uF, 40V	50c
680uF, 35V	50c
0.015uF, 250V	25c
1uF, 100V	25c
1000uF, 16V	50c
220uF, 16V	50c
2000uF, 63V	$1
0.47uF, 400V	50c
680K, 250V	25c
012, 250V	25c
15NF, 250	10c
120K, 250V	20
10uF, 315V	25c
0.056, 250V	10c
500 MFP 10 VOLT	5 FOR $1

Slide Pots

250K-50K	3 for $1
Dual 500K	3 for $1
1 Meg	3 for $1
2 Meg	3 for $1
Including Fancy Gold Knobs	
25K dual	2 for $1

SPECIAL

100 mixed resistors, all useful	$2
100 mixed capacitors, fresh stock	$2

AUDIO LEADS

3.5m to 3.5m, 7ft	75c
3.5m to 6.5m, 7ft	75c
6 5, 7ft	50c

MICRO SWITCH

5A, 250V AC ... 75c ea.

TUNING CAPS

2 and 3 gang	$1 ea.
Min 2 gang	50c

FUSES

0.5A, 2A, 3.25	10 for $1
In line fuse holders	30c
RCA jack plugs and sockets	40c pair
1A, 10 for	$1

SPECIAL TRANSISTORS

AD 161-162	$2.50 pr
BSC 901A	$1.50 ea.
BC 548	10 for $1
AD 149	$3 pr
OC9554	50c
BD202N	50c
BD135	50c
2NC055	$1

ELECTROS

470µF, 25V	5 for $1
400uF, 10V	5 for $1
47uF, 63V	5 for $1
350uF, 16V	2 for $1
27uF, 160V	5 for $1
25uF, 63V	10 for $1
22uF, 160V	10 for $1
47uF, 16V	5 for $1
47uF, 200V	5 for $1
220uF, 10V	10 for $1
68uF, 16V	10 for $1
100MFD, 350V chassis mount	$1

- Telescopic aerials, $1.50
- 6 inch ferrite rods, 75c
- Rainbow lead, 5 strand, 20c per metre
- Line output transformers, 600 ohm, to 15 ohm, 20 watts, $5
- Line output transformers, 1200 to 3/ohm, 5 watt, $1
- Power supply units, filtered, 240 to 20 volt, $12

Power leads 240 volt, suit most tape recorders, radios, etc. $1 each.

TV Stick Rectifiers 20SC, $1.00.

Philips Colour TV Convergence Boards, $3 each.

455KC IF Transformers for valve radios, $1 each. Also aerial and OSC coils, 75 cents each

POTS ROTARY

½ Meg	30c
1 Meg	30c
100K	30c
100K Switch	50c
50K Double Pole Switch	50c
7 500	30c
10K Switch	50c
250K	30c
50K	30c
20K	30c
10K Min Pots	25c
50/Ohm	50c
½ or 1 Meg Switch	50c
½ 1 meg dual Concentric tapped at 100K	$1
2 meg ganged double pole switch	$1
1.5 meg dual ganged	50c
2 meg ganged log	$1
1 meg dual ganged	$1
½ meg dual ganged LIN	75c
25K, 50K dual ganged Concentric double switch	$1
200K single line	30c
20K wire wound	75c
dual log 10K	75c
100K dual ganged linear pots	75c
10K sub min log pots	50c
250K ganged pots	75c
25K lin ganged pots	75c

HOR Drive 3021 transformers for colour TV ... **$2**
TV Colour Convergence Units 11270 44 x 6 ... **$3**

PILOT LIGHTS

Screw in 6.3V	10 for **$1.50**
24V	10 for $1.00
Pilot light holders	$1.50

- Car radio suppressors, 3 for $1
- 3 position slide switch, 50c
- Toggle switches, 25c
- 2 position push button switch, 50c
- 6 position push button switch, $1
- 4 position push button switch, 75c
- Transistor ear plugs & leads, 3 for $1
- In-line fuse holders, 4 for $1
- 4 pole 2 position rotary switches, 50c

Pick up Cartridges BSR universal type Ceramic Stereo ... **$5**
Audio Technica AT6 diamond stylus stereo ... **$12**

DIODES

OA 626	4 for $1.00
OA 662	4 for $1.00
EM 410C	4 for $1.00
DS 150A	50c
DSY 130YO	50c
OA 636	50c
HR 15	50c
Diodes BYX 55, 300	30c
BY 188	30c
DIODES BAV20 10 for $1	
Valve sockets 7 pin	10c
Valve sockets 9 pin	10c
OCTAL	10c
09478	5 for $1 00
BZX79	5 for $1.00

SUPER SPECIAL

GRAMOPHONE motor and pickup 3 speed stereo balanced arm

240 volt $9 75
PP NSW $1 50
Interstate $2 75
WA $4

$250 WA $3 50

FRONT END COMPLETE PUSH BUTTON TUNER SECTION
TO SUIT PHILIPS, PYE, KRIESLER ETC. **$25**

PORTABLE 4 speed RECORD PLAYER
$28

Power transformers 240V, 117V, 2/25V Tapps

SPARK GAPS 500 volt 20 cents
THERMISTERS 20 cents

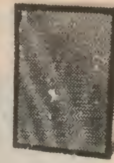
PICK UP ARMS

Mono	$3.50
Inc Ceramic Cartridge & Stylus	
TRIMPOTS	
200 ohm	10c
5K	10c
100K	10c
47K	10c
10K	10c
470 ohm	10c

Miniature speaker and drive output transformers ... $1 pr

Special mixed tag strips ... 10 for $1

SPEAKER SYSTEMS



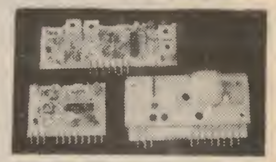
Inc one 6 x 4 speaker, 5W RMS, $4 75 ea. P&P NSW $1 80, Interstate $2 80, WA $4 (For singles or pairs.)

SPEAKER SPECIALS

5 inch in 3.5 8 or 15ohms $3.50
15 ohm 4" — 2 for $2.
6x9 15 ohm $5 each
5x7 15 ohm $4 each
8x4 15 ohm $4 each
6x4 15 ohm $3 each

SUPER SPECIALS

FM STEREO TUNER KITS



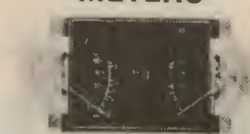
Sets of 3 modules include FM tuner, decoder and IF detector. Circuit diagram supplied. Can be used with amp modules.

ONLY $22
P&P $1.00

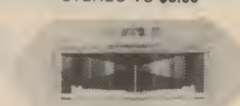
TRANSISTORS

2N3055	$1 20	AC187	50
SE1002	4 for $1	2NC3055	50
BF459	50	2SB407	$1.00
B544 DE6	50	BC549	5 for $1 00
C106 F1	50	2SC154B	50
TIP 110	50	OC968	5 for $1.00
608EK	4 for $1	608EK	5 for $1.00
BCS548	10 for $1	DS113AG	75
2SB186	50	BD236	50
2SA101	50	BD139	50
BD263	50	BD135	50
BSB405	50	2SA240	75
2SB77	50	BF469	50
2SB303	50	BD235	50

VU & BALANCE METERS



STEREO VU **$3.00**

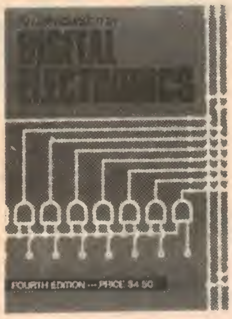


12Kn 100uA **$2.00**

TV TUNERS

$2.50 + P+P

AN INTRODUCTION TO DIGITAL ELECTRONICS



Electronics is going digital. This book can help YOU go right along with it.

Electronic equipment now plays an important role in almost every field of human endeavour. And every day, more and more electronic equipment is "going digital". Even professional engineers and technicians find it hard to keep pace. In order to understand new developments, you need a good grounding in basic digital concepts, and An Introduction to Digital Electronics can give you that grounding. Tens of thousands of people — engineers, technicians, students and hobbyists — have used the previous editions of this book to find out what the digital revolution is all about. The fourth edition has been updated and expanded, to make it of even greater value.

Available from "Electronics Australia", 57 Regent St, Sydney. **PRICE $4.50** OR by mail order from "Electronics Australia", PO Box 163, Beaconsfield 2014. **PRICE $5.20.**

ELECTRONICS AUSTRALIA

PRINTED CIRCUIT BOARDS AND FRONT PANELS

Some readers have indicated problems obtaining PC boards and front panels for projects. Many of our advertisers sell these items and advertisements in the magazine should be carefully checked in the first instance. Failing satisfaction from this source, the following is a list of firms to which we supply PC and front panel artwork. Some may sell direct, others may only be prepared to nominate sources from which their products can be obtained.

N.S.W.

Dick Smith Electronics,
PO Box 321,
North Ryde, NSW 2113.
Telephone: 888 3200

Electronic Agencies,
115-117 Parramatta Road,
Concord, NSW 2137.
Telephone: 745 3077

RCS Radio Pty Ltd,
651 Forest Road,
Bexley, NSW 2207.
Telephone: 587 3491

Radio Despatch Service,
869 George Street,
Sydney, NSW 2000.
Telephone: 211 0816

VIC.

Kalextronics,
4 Burgundy Plaza,
101 Burgundy Street,
Heidelberg, Vic. 3084.
Telephone: 743 1011

Rod Irving Electronics,
425 High Street,
Northcote, Vic. 3070.
Telephone: 489 8131

Sunbury Printed Circuits,
10 Counihan Street,
Sunbury, Vic. 3429.
Telephone: 744 2852.

S.A.

James Phototronics,
522 Grange Road,
Fulham Gardens, 5024.

W.A.

Jemal Products,
8/120 Briggs Street,
Welshpool, WA 6106.

N.Z.

Marday Services,
PO Box 19 189,
Avondale,
Auckland, NZ.

Mini Tech Manufacturing Co Ltd,
PO Box 9194,
Newmarket, NZ.

Printed Circuits Limited,
PO Box 4248,
Christchurch, NZ.

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Name ....

Address ....

Postcode .... **Enclosed is** .... **for** .... **years**

ADVERTISING INDEX

THE IDEA BEHIND OUR RADIO CASSETTE RECORDERS.

The stereo headphone represents perfect stereo reproduction.

As well as receiving sound through your ears, you appear to receive sound from above your head.

This added dimension in sound is stereo.

Of course, anyone can get this sound from any good stereo radio cassette recorder if they listen through stereo headphones.

But, at JVC, we realised it was impractical to wear stereo headphones all the time.

So we invented a new kind of sound system just for our stereo radio cassette recorders.

The Biphonic System.

This exclusive system offers 3-dimensional sound effects, so you enjoy true stereo reproduction without headphones.

If you'd like to know more about the many innovations JVC has brought to the stereo radio cassette recorder, write to us for a brochure, or call in to any JVC dealer.

Then you'll see why JVC equipment is recognised as The State of the Art.

JVC

JVC Advisory Service, Private Bag, Kingsgrove, N.S.W. 2208 or phone (02) 750 3777.

JVC0058/EA/FMMH

RARE ADDITIONS FROM MARANTZ. SLIMLINE AMPLIFIERS.

Rāre: very valuable.
Addi'tions: the things added.
Mar'ăntz: a range of ultra-high performance Slimline and three-quarter size Amplifiers which blend state-of-the-art engineering with operational versatility.

Although all units in a hi-fi system must be compatible in order to achieve optimum sound quality, there is no question that their final standard of performance relates directly to the main amplifier. It is the heart of the system and the point at which distortion is most likely to be introduced.

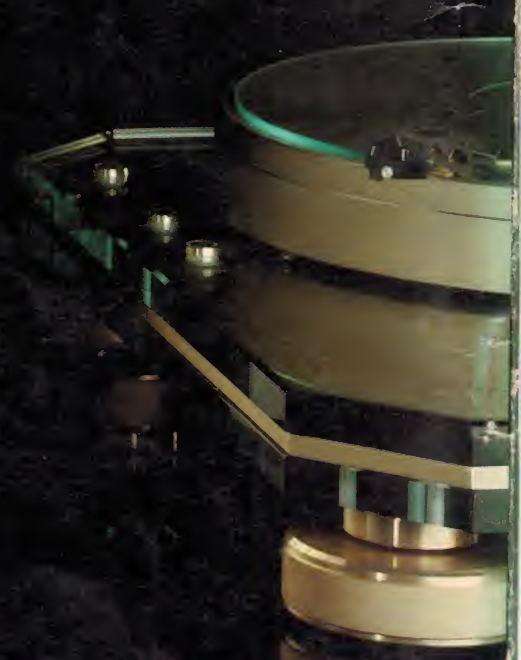
Marantz engineers have developed special techniques for reducing the various forms of distortion to miniscule levels. This is achieved by the use of a highly efficient negative feedback system and operation in class AB, with the careful selection of "shortest path" wiring to avoid interaction between different stages in circuitry and with the other channel.

The more powerful models are equipped with a heat-loop cooling system for the output stage transistors. This NASA invention enables the heat dissipated at high power levels to be rapidly removed so that a considerably improved power-to-size ratio is obtained.

If you see your hi-fi as an investment and, if you demand critical performance standards as well as the best value for money, listen to the future.

Listen to Marantz.

marantz
Now you're listening.



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